REPORT ON REFUSE DISPOSAL

FOR

MUNICIPALITY OF METROPOLITAN TORONTO

May, 1967

JAMES F. MacLAREN LIMITED CONSULTING ENGINEERS TORONTO - LONDON

in association with

BLACK & VEATCH CONSULTING ENGINEERS KANSAS CITY, MISSOURI

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REFERENCE NO 767

Mr. R.L. Clark, P.Eng.,
Commissioner of Works,
Municipality of Metropolitan Toronto,
11th floor, East Tower,
City Hall,
TORONTO 1, Ontario.

Friday May 19th, 1967

Report on Refuse Disposal for Metropolitan Toronto

Dear Sir,

Acting with our associates for this study, Black and Veatch of Kansas City, Missouri, we are pleased to submit our report on refuse disposal for Metropolitan Toronto. This report was prepared under authority of a resolution of the Metropolitan Council passed on March 22, 1966 which adopted Clause No. 4 of Report No. 4 of the Metropolitan Works Committee and was subsequently officially transmitted to us by a letter from the Metropolitan Clerk dated March 23, 1966.

The report of the Commissioner of Works of March 3, 1966 upon which the resolution included in Report No. 4 was based contains the following statements with reference to our engagement.

"Disposal of garbage, industrial and demolition materials along with other solid and liquid wastes generated by our society is one of the major problems confronting urban municipalities today.

According to recent surveys, few communities on this continent have developed comprehensive master plans to cope with this environmental enigma over the next few years. The Federal Government in the U.S. recently gave serious attention to the waste problems in that country and the research and planning considered essential.

"The Premier of Ontario has indicated that this function will become a Metropolitan Toronto responsibility as of January 1, 1967, pending passage of legislation to implement changes in the Metropolitan structure of government following receipt of the recent Royal Commission report.

While it may appear premature to become involved prior to legislation, the timing of preparatory steps for acceptance of this new responsibility is such that action must be taken immediately. Comprehensive studies of the problem must be carried out, with development of a long-range programme indicating facilities required, the economics, and the acceptability of landfills, incineration, etc.....

.....We recommend the engagement of James F. MacLaren Limited, who will associate themselves with Messrs. Black and Veatch, to prepare a full-scale report on the needs within the Metropolitan Toronto Planning Area for refuse disposal; and to make recommendations relative to construction, land acquisition, disposal methods, financing and administration, required in connection therewith."

The matter of refuse generation within the Metropolitan Planning Area has now been investigated as have the optimum methods for the disposal of refuse collected within the Municipality of Metropolitan Toronto, together with other pertinent and related subjects. The results of these investigations and studies are reported as observations, and recommendations hereafter. In addition, a separate Technical Discussion has been prepared which outlines in detail the various studies comprising this investigation and the resultant observations on which this report is based.

In recent years, there has been a significant improvement in the standard of refuse collection service in the municipalities within the Metropolitan Area. Collections are now normally made from each residence at least twice per week, using modern closed vehicles, mainly of the compaction type.

The simultaneous requirement for providing improved and adequate disposal facilities was not accepted so readily. While the standard of collection service was apparent to every refuse producer the ultimate disposal was a far more remote concern.

Refuse is normally considered as waste having no commercial value so that the idea of having to expend considerable sums for its further processing or disposal can never be popular. For many years, open dumps were permitted; at some of these burning was allowed and occurred spontaneously at others. Such dumps provided breeding grounds for flies and vermin with consequent public health hazards. Where incinerators were built, they were designed to satisfy their primary purpose only, i.e. that of burning the putrescibles and reducing the volume of material ultimately remaining to be disposed of by landfill. For many years no thought was given to the air pollution resulting from incineration.

More recently, the increasing awareness of the effect of refuse disposal on the environmental health of the populations of urban areas has brought emphasis to improving disposal methods. Also the volume of refuse requiring disposal each year has continued to grow as a result of increases in population and in the per capita rate of refuse generation. In Metropolitan Toronto the effect of such increases has been to overload incinerators and to cause more rapid filling of landfill sites.

Metro first became involved in the disposal of refuse in 1955 when it assisted in the landfill operations for reclamation of land now known as Marie Curtis Park in the former municipality of Long Branch. Metro subsequently conducted similar landfills in other municipalities with the concurrence of the municipality in each case.

An amendment of the Municipality of Metropolitan Toronto Act 1960 gave official recognition to these operations by Metro. The relevant Clause 257 was as follows:

> *"257. – (1) The Metropolitan Corporation may acquire, use or occupy land and may erect, maintain and operate buildings, structures and machinery for the purposes of dumping and disposing of garbage, refuse and domestic or industrial waste of any kind and may regulate the dumping and disposing of garbage, refuse and domestic or industrial waste of any kind upon such land and charge fees therefor.*
>
> *(2) The powers conferred by subsection 1 shall not be exercised without the approval of the area municipality in which the land is situate or the dumping and disposal operations are to be carried on."*

Despite this service provided by Metro and the continuous efforts and cooperative programmes of the area municipalities the problem of refuse disposal has become more serious and is now one of major and imminent concern due in the main to -

1. the steady depletion of available landfill areas within Metro and the frustration

of Area Municipalities in obtaining financial and public health approvals and the acceptance of the public for any new disposal facility.

2. the necessity for rigid interacting controls on the pollution of air, soil and water;

and in a lesser degree to -

3. the decline in markets for major salvage items such as ferrous metal, paper, manure and waste oil.

This then was the situation existing in 1966 when the Government of the Province of Ontario approved under Section 10 of Bill 81 the transferring to the Metropolitan Corporation on January 1st last the responsibility for the ultimate disposal of waste from the Area Municipalities, while leaving its collection as a local responsibility.

The enactment of such legislation provided an opportunity for the Metropolitan Corporation to develop a long range refuse disposal plan on a regional basis considering therein the interests of the Fringe Municipalities included within the limits of the Metropolitan Toronto Planning Area. Also it has been recognized that for too long have municipalities concerned themselves only with providing for the disposal of wastes publicly collected. In this authorization it has been recognized that the Metropolitan Corporation must be concerned with all refuse generated within the Metropolitan limits whether publicly or privately collected.

It follows, therefore, in view of the foregoing that the Metropolitan Corporation effect a programme for refuse disposal which provides the greatest protection to the environmental health of the area's population at the minimum disposal cost while:

1. providing for the annual disposal in even the first year of operation of a weight of refuse which exceeds 4,500 tons per day.

2. maintaining reasonable equity in the direct haul costs of each of the area municipalities.

Two interim reports presented on June 29 and September 26, 1966, respectively, have served to provide information on interim disposal facilities required by the Metropolitan Corporation's acceptance of disposal responsibility on January 1, last. They are included in the appendices of the technical discussion and their recommendations, where relevant, are re-stated in the major recommendations of this report to prevent misunderstanding or confusion.

Accordingly, with the problem recognized by Municipality and Province alike, as evidenced by the responsibility having been legally vested in the Metropolitan Corporation, the presentation of this plan is both timely and necessary and its implementation most worthy of consideration.

The study itself has required an extensive analysis and review of all refuse disposal practices currently employed in applicable areas of the world, especially North America, and the potential of their application to Metropolitan Toronto. It has required detailed discussions and observations regarding all refuse collection and disposal facilities whether operated publicly or privately in the Metropolitan Planning Area and in particular the analyses of records of refuse collected publicly or privately in the area municipalities themselves.

From such analyses estimates of total refuse generated and its distribution in

respect to source have been prepared on sound technical bases and an optimum comprehensive plan for the proper disposal of these quantities has been developed. For this plan, only those disposal methods which are considered practicable for this geographic area have been selected and recommended. Estimates of cost and administration and policy procedures required to implement the plan are included.

OBSERVATIONS

As a result of these investigations and studies, the following observations relating to refuse disposal in the Metropolitan Corporation specifically and in the Metropolitan Toronto Planning Area generally appear warranted.

Assumptions

Certain basic concepts were adopted as necessary assumptions in establishing the scope of the report as follows:

(a) The study area includes the 720 square miles of the Metropolitan Planning Area which prior to January 1, 1967 included 26 municipalities having a population of approximately two million people. The study, however, is concentrated in the 240 square mile portion of the Planning Area designated as the Municipality of Metropolitan Toronto comprising 13 municipalities and 1,800,000 people prior to January 1 last, and now consolidated into five boroughs and one city. Although under the terms of Bill 81 the Metropolitan Corporation is not required to provide for the disposal of materials generated outside the Corporation limits, accounts must be taken of the refuse generated in a Fringe Municipality to ensure that disposal arrangements for that municipality's refuse are not adversely affected by the creation of a Metro disposal facility.

(b) The definition of refuse utilized herein represents the definition of waste set out in Bill 81 and interpreted in the broadest sense to include garbage, rubbish, ashes, street sweepings, leaves, dead animals, abandoned vehicles, industrial wastes not disposable to the sewerage system, demolition wastes, construction wastes, scum, grease and screenings from pollution control plants and special hazardous wastes such as radioactive materials, explosive wastes, pathological wastes, etc.

The foregoing definition represents materials whose disposal will be covered in this report. Specifically excluded from the definition are excess excavated material, top soil and masonry rubble generally classified as "clean fill". Also sewage and septic tank sludge are similarly excluded from this study since the disposal of these wastes has long been a responsibility of Metro and in any case the methods of disposal for these wastes are generally not compatible with methods employed for the disposal of refuse as defined.

(c) It was assumed that to be of value any comprehensive plan for refuse disposal for an area of this extent should be programmed for some reasonable period into the future. It was, therefore, determined that 20 years or until 1986 would be a reasonable planning period. This period would be divided into five-year increments with some general consideration also being given to requirements beyond 1986. The plan of course would be subject to review at frequent intervals which should not be less than five years apart to ensure the compatibility of actual developing conditions to those forecast in the plan.

(d) This plan is conceived with respect to the disposal of refuse as previously defined in (b) above. It is not limited to the portion which is collected by the municipalities but includes that collected by private agencies and that transported directly by those industries or persons actually generating the wastes.

Existing Conditions

To determine present methods of collection and disposal of refuse in the Metropolitan Planning Area, the former thirteen Area Municipalities (now six) were visited and their systems discussed and studied in detail. Also, the collection and disposal methods employed by each of the Fringe Municipalities were determined. From these reconnaisance surveys the following observations were made:

(a) The Area Municipalities generally follow a uniform policy of twice weekly collections from residences with bulky refuse collected once weekly. Certain commercial establishments are provided with a daily collection service often accomplished at night. All municipalities operate a municipally owned collection system. Virtually all industrial wastes and some commercial wastes and some residential wastes are collected by private contractors.

Disposal methods employed by the Area Municipalities were landfills and incineration. The degree of compaction and maintenance of cover as observed at each of the landfills required improvement for optimum operation. Some of the incinerators were obsolete and were so located that access to them over traffic arteries was far less than adequate as was the level of air pollution emanating from their stacks which in fact was in excess of that permitted by current legislation.

(b) In the Fringe Municipalities, the practices in respect of collection vary widely from twice per week to none at all and from municipally operated to direct arrangement by the householder with a private collector. Disposal with the exception of one open pit incinerator is by fill or more appropriately dumping with burning at the dump often being permitted. Backyard incineration is also permitted in many instances. Much of the industrial refuse privately collected from the Area Municipalities is disposed of in privately owned landfills in the Fringe Municipalities.

(c) Generally speaking, the Area Municipalities had inadequate disposal facilities as of January 1, 1967 when Metro assumed responsibility for disposal. No additional facilities were available at that time and the actual take over was limited to the ownership and operation of all the incinerators within the Metropolitan limits. The Area Municipalities operating landfills immediately prior to January 1, were authorized to carry on their operations as Metro's agents until October 1 next when it is anticipated that sufficient of the new disposal facilities recommended herein will become operative.

(d) The present state of the collection and disposal of refuse in the Metropolitan Toronto Planning Area is set out in detail in Table No. 1 and 2 and the operating disposal sites are indicated on Figure III-1.

(e) Industrial refuse and certain commercial refuse collected by private contractors or the persons directly generating the refuse is disposed of as previously indicated to the operating facilities shown in Figure III-1.

Liquid industrial wastes which cannot be accepted in their initial state into the Metropolitan Corporation's sewerage system provide a more serious problem than other types of refuse. Usually the disposal method adopted by the industry involved is the most economical that can be determined and not necessarily the most desirable. At the present time, these wastes either are trucked to a landfill site where they are dumped and allowed to percolate into the ground, or are treated to an acceptable level by the industry and discharged to the sewer. In certain instances liquid wastes are dumped in locations well beyond the limits of the Metropolitan Planning Area because of the fact that most landfills prohibit the dumping of such materials. Also, it is believed because of the difficulty of disposing of these wastes, certain illegal and indeterminate procedures are being followed which may lead to dangerous levels of pollution in isolated lakes, creeks and ponds in the area. Liquid wastes constitute a major waste problem that must be recognized in this programme.

Study Methodology

The basic problem in the study was to compile and arrange the collection and disposal data in such a manner that they could be correlated so as to disclose the actual quantities of the major types of refuse collected from specific geographical areas over the year, the cost of carrying this out to public and private agency alike, the manner, type and degree to which these various wastes reached the different disposal sites and the costs incurred in providing for their disposal.

From the foregoing, forecasts of future quantities of refuse could be made and economic studies carried out to determine the most appropriate method of hauling and disposing of such wastes both now and in the future including the use of existing facilities.

Refuse Quantities and Composition

The planning districts as delineated in the "Supplement to the Official Plan" dated December 1965, prepared by the Metropolitan Toronto Planning Board, were used as individual refuse generating areas to determine present and future quantities of refuse collected by the municipalities and by private haulers. Quantities of other types of refuse were determined on a Metro Area basis. The existing quantities of municipally collected refuse in the Metro Area were determined by reviewing existing municipal records and monitoring disposal sites where necessary. The refuse quantities were then distributed to each planning district on a per capita basis. The existing quantities of privately hauled refuse in the Metro Area, representing the solid industrial wastes, were determined by monitoring the disposal sites. The quantities were then distributed to the planning districts on a per acre of commercial and industrial development basis.

The population and commercial and industrial acreages development for the design period were determined for each planning district. Some minor adjustments to quantities were made on the basis of differences in types of developments. Quantities of municipally collected refuse were increased in recognition of the future probable banning of private incinerators in apartment buildings. Quantities of refuse were determined for the Fringe Municipalities on the basis that they would be similar to those for the bordering planning districts of Metro. Also each of these types of refuse was increased in quantity at the rate of 1-1/2% per year to provide for anticipated unit increases in refuse generation.

Figure V-1 shows the Planning Districts: Tables V-1 and V-2 show the estimated projections of population and the quantities of municipally collected refuse for various periods throughout the design period. Tables V-3 and V-4 show the estimated projections

of commercial and industrial acreage development and the quantities of privately collected industrial and commercial refuse throughout the design period. Table V-5 shows a summary of these projections plus quantities of other types of refuse for the Metropolitan Area.

From the foregoing, it can be observed that at the present time more than 4,500 tons of refuse is generated daily within the Metropolitan limits and it is forecast that this will increase to 8,000 tons per day within the next 20 years. Only 45 percent of these amounts represents the portion of refuse collected directly by the municipalities themselves.

Liquid industrial waste quantities and types were estimated by surveying the liquid waste hauling contractors and a selected cross-section of industry.

The following table summarizes the estimated quantities of liquid industrial waste:

Types of Waste	Annual Volume gallons
Inflammable Liquids	4,000,000
Acidic Wastes	
Pickle Liquor	3,041,000
Other Acidic Wastes	3,000,000
Alkaline Wastes	
Carbide Lime	6,500,000
Other Alkaline Wastes	1,156,000
Inert Solutions	600,000

Since there is no apparent logical method of estimating future increases or decreases in the quantities of these materials, none was attempted.

The composition of municipally collected refuse was estimated by sampling and classifying refuse from selected areas throughout the Metro Area. The results of this operation are shown in the following table.

Refuse Components	Totals for one week refuse collected	
	Pounds	Per Cent of Total
Combustibles		
Paper and Cardboard	465.6	39.5
Food Wastes	381.2	32.4
Vegetation	76.3	6.5
Plastic	30.6	2.6
Rags	17.7	1.5
Wood	12.0	1.1
Other Misc. Combustibles	13.5	1.1
Total Combustible Components	996.9	84.7

Non-Combustibles			
Glass		94.4	8.0
Cans		64.5	5.5
Metal - Ferrous		3.5	0.3
- Non-Ferrous		0.9	0.1
Other Misc. Non-combustibles		17.2	1.4
Total Non-combustible Components		180.5	15.3
	Total Sample	1177.4	100.0

Refuse Haul

Hauling refuse is a very significant factor in the determination of refuse disposal practices and costs. As disposal sites become more remote from the refuse generation areas haul costs increase so that more expensive disposal methods must eventually be contemplated closer to the generation area to confine haul costs. It is, therefore, necessary to establish an optimum cost balance between haul and disposal.

There are two types of haul to be considered: direct haul and transfer haul. Direct haul refers to the hauling of refuse in the collection vehicles from the end of the collection route to a disposal or an unloading facility and returning to the collection route. Direct haul is calculated on a per ton mile basis and includes the cost of the return trip. Transfer haul refers to the hauling of refuse in a non-collecting vehicle to a disposal site. The transfer haul cost is calculated on a per ton mile basis and includes the cost of the transfer of refuse from the collection vehicle as well as the return trip. Direct haul costs of the municipalities of Etobicoke, East York, York, North York, Scarborough and the City of Toronto were determined from reviewing the municipalities' cost records. The current municipal practice of permitting the collection crew to ride in the collection vehicle to the disposal facility was recognized in the direct haul cost determinations. From following collection vehicles in the Metro Area, it was estimated that vehicles travel at about 20 m.p.h. on local streets and at about 40 m.p.h. on expressways. Reasonable haul costs for municipally and privately collected refuse were estimated and are shown in the following table:

Type of Streets or Road travelled	Estimated Haul Speed (ave. m.p.h.)	Estimated Average Haul Costs for Municipally and Privately Collected Refuse	
		Municipal $/ton mile	Private $/ton mile
Local Streets	20	0.40	0.26
Expressways	40	0.20	0.13

In view of the foregoing costs, it was obvious that at some point it would be more economical to unload the collection vehicles through some appropriate facility and transfer their loads to high speed, high capacity vehicles for rapid transfer to the disposal sites.

Discussions with both railways and detailed calculations carried out from information received further disclosed that any suggestion of utilizing rail facilities for transfer haul was impracticable since charges resulting from demurrage and transfer problems created costs far in excess of those considered reasonable by other methods.

The applicable transfer system to be compared and considered as an alternate to

direct haul, therefore, became a system consisting of a transfer station and its associated transfer vehicles. The transfer station would be located centrally with regard to the refuse generation area so that collection trucks could rapidly unload their refuse into transfer trailers or a storage pit and return to their collection routes. At the station, high speed high capacity tractor-trailer transfer vehicles would accept the load and haul over nearby expressway style roads to the disposal area. To be successful, this operation requires careful planning and control to permit speedy turn round of vehicles and to maintain clean and hygienic conditions that will ensure public acceptance of the transfer operation.

Figure VI-1 outlines the unit costs that can be anticipated with transfer haul, such costs depending on transfer station capacity, haul time and distance.

Disposal Methods Considered

The disposal methods currently in use within the Metropolitan Planning Area, as previously indicated, include landfill, incineration and dumping with open burning. Only the first two can be considered methods of acceptable practice today, and as previously indicated, neither of these is carried out at the present time in an optimum fashion. Of all the disposal methods available only the following can be considered as possibly applicable to Metro's long-range refuse disposal plans:

1. Sanitary land filling
2. Incineration at a central plant
3. High rate central composting
4. Lake shore filling
5. Neutralization plan for particular liquid industrial wastes
6. Pumping certain liquid wastes to depth
7. Salvaging

All of the foregoing were given serious consideration as disposal methods which might be employed. These preliminary considerations indicated clearly that in this instance only sanitary landfilling and central incineration could be considered in detail for virtually all refuse with the exception of liquid wastes for which neutralization and certain other methods would have to be considered.

High rate composting has been developed by several major manufacturers as a means of digesting refuse to an inoffensive humus suitable for soil conditioning by employing controlled mechanical methods to reduce the organic and bacterial content of the refuse to a non-offensive level. The process is the subject of much promotion and "overselling" at the present time. Its justification economically is very much in doubt for North American communities.

The basic fact is that in North America there is today no market for the type of humus produced in the process. Because of their low cost and ease of application, inorganic fertilizers have practically monopolized the crop land fertilizer market in recent years. These chemical fertilizers have virtually eliminated the need for soil conditioners as is evidenced by the inability of sewage treatment plants to dispose of more than a small portion of their heat dried sludge for soil conditioning purposes.

In summary, composting is applicable to part of the waste only. It is a process which reduces a portion of the refuse to a lesser volume but the resultant residue has no proven market in this area; also the process costs of composting exceed those of incineration. For these reasons, the process is not a practicable one in this instance.

Although it is recognized that dumping of refuse in Lake Ontario could never be accepted by international or public health authorities, it has been felt that land reclamation programmes, utilising sanitary landfill, along the lakefront through Metropolitan Toronto might be practicable, especially in the light of Metro's waterfront plan. Extending perimeter dykes from the shore and filling in the dry behind these dykes on landfill procedures was considered possible. Long term maintenance of water levels in the dyked areas would presumably ensure that no pollution from these areas would reach the lake waters.

Although such a scheme may be theoretically possible, limitations in actual operational control make it impracticable and any current schemes of this type carried out in other areas of the continent have encountered eventual pollution and odour problems. Even after complete digestion of the fill material, nitrates and phosphates remain to fertilize the shore water and promote the everpresent insidious growths of algae. The scheme has far too many pitfalls to permit its consideration in this programme.

Such a procedure may be considered for incinerator residue and fly ash, but even in that instance, fertilizing chemicals remain to act as a catalyst for algae development. However, if provisions are made for adequate drainage and dykes are constructed to withstand long term erosion and wave action, ash disposal by lakefront filling can be considered.

Filling with clean earth fill and rubble, has of course been carried on with respect to the lakefront for some years and is perfectly satisfactory.

Several components of refuse have potential salvage value, including paper products, rags, glass and bottles, non-ferrous metals and ferrous metals including tin cans. None of these salvage operations, if instituted, would substantially reduce the weight of refuse to be disposed of but could possibly provide monetary return sufficient to defray some disposal costs. However, popular though refuse salvage once was on this continent and still is in areas of low labour cost, it is no longer considered practicable in North America for most purposes because of the following:

1. Labour costs in relation to efficient sorting methods are generally too high to make the venture profitable.

2. Most salvage operations seriously interfere with the disposal operation and thereby reduce the effectiveness of the overall disposal programme.

Also a typical economic difficulty with salvage operations is that large scale salvage from municipal refuse can saturate the salvage market and depress prices.

Magnetic separation of ferrous metals including tin cans from incinerator ash might be considered a possible area of salvage value but it should only be embarked upon where the operation can be arranged in such a manner that the main disposal system suffers no disruption either during normal operation of the salvage process or in the event of mechanical breakdown or cessation of operation from any other cause. Salvage is an operation which is best handled by private contractors; no public salvage operation should be considered.

Salvage is often a practical means of disposal in respect of auto bodies and heavy metal refuse and private contractors should be encouraged to accept these wastes from the municipality.

In certain regions, noxious and dangerous liquid industrial wastes can be satisfactorily disposed of on a long-term basis by pumping these liquids to deep, pervious

cavities in the bed rock of the area. Such a facility is often expensive to develop and to control but it can provide a reasonable solution for a most difficult and dangerous problem. Unfortunately, the geological sequence in the Metropolitan area clearly demonstrates that the bed rock does not provide the pervious quality necessary to support this type of development.

Applicable Disposal Methods

(a) Sanitary Landfill

One of the disposal methods considered most applicable for Metropolitan Toronto is sanitary landfilling. This method is, without question, the most popular refuse disposal system employed on the continent today. Unfortunately, these fills are more often constructed and operated improperly than according to optimum procedure, and in this regard the fills of Metropolitan Area municipalities have been no exception. For this reason, the process has often received unfair public criticism.

To be successful and economical, a sanitary landfill must be planned, designed and operated like any other engineering project. Basically the process requires the efficient filling with refuse of a properly prepared natural or excavated cavity in such units as to permit optimum compaction of refuse and its complete and adequate daily cover. The operation must be so carried out as to avoid the placing of materials within the ground water horizon or within the possible drainage pattern of surface or underground water flow.

The determination of sites necessary for sanitary landfills is all important and must be concerned with several major considerations. These considerations are basically of three types, each of which are to a degree interdependant. The first consideration is designed to gain public acceptance and includes such items as isolation, traffic accessibility, future land use, etc. The second consideration is necessary to ensure that required pollution abatement goals can be attained and includes such items as topography, ground water regime, surface drainage, gas travel etc. The third consideration is necessary to determine the cost of development and operation and includes such items as capacity, cover availability and characteristics, location, etc.

Maps and aerial photography of the Metropolitan Planning Area were studied for potential sanitary landfill sites. An aerial reconnaissance was made of the area. A total of 40 possible sites were examined which appeared from preliminary consideration to be worthy of further study. Of these 40 sites, a total of 11 were deemed to be sufficiently satisfactory to warrant an economic analysis to determine the cost per ton for disposal considering land acquisition, development and finishing costs. Figure VII-1 shows the location of the sites investigated. Table VII-1 illustrates the physical characteristics of the sites investigated and Table VII-2 shows a summary of development and finishing costs for satisfactory sites. Methods of operation were investigated thoroughly and criteria of operating equipment were developed. From these studies costs of operation were estimated for varying rates of filling. Figure VII-5 shows a summary of these estimates.

These figures indicate that development and finishing costs for major landfills should be possible at a unit cost of 65 to 75 cents per ton of refuse disposed plus an operating cost of 65 to 85 cents per ton.

The estimated costs determined for the sites chosen are believed to be sufficient to acquire, develop, operate and complete the sites in a manner which will meet the requirements of environmental sanitation. There is no doubt that minor adjustments in procedures, etc., will be warranted based on detailed design and experience gained for individual sites. However, if the highest standards of operation are not adhered to continuously a satisfactory operation will not be achieved.

(b) Incineration

Central incineration is the other major method of refuse disposal applicable to the Metropolitan Area. It involves the volumetric reduction of the combustible portion of refuse by high temperature burning. The resulting residue is relatively inert and can be disposed of by landfill with little nuisance or necessity for cover to maintain sanitary conditions. Disposal by lakefront filling can also be accomplished if appropriate protective procedures are followed. From consideration of the economy of large units versus problems of refuse haul and traffic congestion it was concluded that incinerators with refuse burning capacities varying from 900 to 1200 tons per day would be the most suitable size for the Metro Area. Consistent with modern incinerator practice and the pertinent circumstances existing in Metro, it was concluded that any new incinerators should include the following features of site, plant elements, and operation:

(a) The site would be in an area designated for industrial development. It would be five to seven acres in size. If on-site residue disposal, which is a distinct advantage, is possible, more land would be required. It would be centrally located with respect to refuse generation quantities and accessible to arterial traffic routes.

(b) The plant structures and site facilities would be designed to ensure good appearance, minimum maintenance, ease of operation and reasonable initial cost. This would involve among other things, extensive use of concrete and masonry units and a minimum of window area.

(c) The refuse handling facilities would include conventional pit and crane facilities. The pit capacity would be equivalent to 2-1/2 days burning capacity. The crane design would be consistent with the latest developments to ensure proper operation at reasonable expense.

(d) Each plant would include three incinerator units. Based on the results of the type of refuse determined from the sampling programme, it is believed that the incinerator units should be designed for refuse with a heating value of about 4,000 to 5,000 Btu per pound. The equipment would include hoppers which would be continuously charged with refuse, water-cooled feed chutes through which the refuse would pass to the drying, combustion and burnout grates which would be of the multiple travelling, rocking or reciprocating type. The furnaces would be refractory lined and automatically stoked. Provisions for underfire and overfire air as well as induced draft would be included to provide proper control of combustion.

(e) Residue would be handled by drag chain conveyors in water impounding steel tanks. The conveyors would discharge to loading out hoppers which would be operated by the residue hauling vehicle driver.

(f) The air pollution control equipment would be sufficient to limit the particu-

late emission to 0.35 to 0.40 pounds per 1,000 pounds of flue gas corrected to 50 percent excess air. The equipment would be of the electrostatic precipitator or high efficiency scrubber type such as the filter bed or flooded orifice design. The large volumes of water required for operation of these facilities and/or cooling the gases would be reclaimed utilizing on-site facilities.

(g) Stacks would be a minimum of 200 feet high and higher if necessitated by location.

(h) Metal salvage equipment could be incorporated to separate metal of the residue, subject to the process not causing interference with the main disposal operation.

(i) The design would include provision to enable the incinerators to be operated 24 hours per day, seven days per week. It is estimated that the plants would process refuse at a minimum of 80 percent of their daily rated capacity over a period of 20 years. It is anticipated that they could readily process refuse at 90 percent of their daily rated capacity particularly during the early years of their services.

Cost estimates for refuse disposal by incineration have been prepared for incinerators of 900, 1050 and 1200 tons per day capacity. The results of these estimates are included in Tables VIII-6, VIII-7 and VIII-8, and indicate that the total annual cost for incineration will vary from $4.35 per ton of refuse burned to $5.65 per ton based on plant capacity and load factor.

The heat in the gases produced by incineration of refuse can be converted to a saleable form of energy to reduce the cost of incineration under certain circumstances. Preliminary studies in the Metro area and directly with the Toronto Hydro-Electric System and the Hydro-Electric Power Commission of Ontario indicate that the market for energy sales either in the form of steam or electricity is marginal at the present time insofar as it might contribute to decreasing the cost of incineration. There is a definite possibility, however, as the potential for central heating grows in the core areas of Metro that this conversion of waste heat from incineration may become more attractive economically and practically. This would appear to be at least seven to ten years away, however.

(c) Disposal of Special Wastes

It has been observed that significant volumes of waste materials are generated daily in excess of the normal refuse collected from residential, commercial and industrial areas. These include fly ash and bottom ash, demolition lumber and construction debris, dead and diseased trees, liquid industrial wastes and seasonal wastes such as autumn leaves and Christmas trees.

The Hydro-Electric Power Commission of Ontario through its Hearn and Lakeview generation stations produces the major portion of fly ash generated in the area and in view of the volumes involved has been experiencing difficulties in obtaining sites for disposal. The material is relatively innocuous but quite bulky. Although the problem has been subjected to a great deal of research no large scale economical conversion of the material to a saleable by-product has yet been developed. One current use for relatively minor quantities is as a substitute for a portion of the cement in large mass concrete structures to reduce heat generation and consequent thermal movement. Permission to dump in Lake

Ontario has been refused by the Ontario Water Resources Commission because of the tendency for a portion of the fly ash to float. The material can be used to advantage in reclaiming or improving land.

Liquid wastes constitute a major disposal problem. With the exception of miscellaneous and innocuous liquid wastes, such as marble cutting slurries, lint and dirt sludges from laundries, etc., which can be disposed of in sanitary landfills, their satisfactory disposal continues to frustrate most authorities. Industy should be encouraged to render their own wastes innocuous because generally it is more economical to treat them at their source where their composition is known, than elsewhere.

Inflammable liquids constitute a particularly difficult problem. In a sanitary landfill they constitute a serious safety hazard to the operations and they may be a dangerous source of pollution. It is very difficult to burn them in a controlled manner in a special central incinerator largely because of their variation in composition and physical characteristics. It is possible that they might be burned in an open pit if an area can be found where the resultant air pollution would not be a hazard. It is doubtful if such an area exists in the Metropolitan Planning Area.

A significant percentage of liquid wastes cannot be discharged to the sewerage system because of their corrosive properties. These wastes are either acidic or alkaline and usually a particular industry generates either one or the other. These wastes when mixed would react so that the resultant would be virtually a neutral liquid. The problem of delivering these wastes to a central location is difficult. However, a pilot scheme of mixing lagoons could be developed to gain practical experience in neutralization without a substantial commitment in capital.

Of those materials resulting from demolition and construction, used lumber presents the greatest disposal problem. Other materials often are salvaged or are in small quantities. This material can be most economically disposed of in landfills.

Trees, brush and stumps present a disposal problem and the local quantity is affected to a great extent by the widespread incidence of the Dutch Elm disease. These materials can be reduced in volume by burning in special incinerators but disposal by landfill is more economical in the Metropolitan Area. Loose brush in a landfill is very difficult to handle but this difficulty is eliminated if the brush is chipped first.

Disposal of seasonal wastes such as leaves and Christmas trees present another specific waste disposal problem. Parks Departments are currently composting leaves for their own use. This practice is an ideal solution to the problem and should be encouraged. Generally, Christmas trees are burned in the open. This is acceptable but air pollution may be a significant result. They can be chipped and disposed of in a sanitary landfill.

Manure is becoming a difficult waste to dispose of because of the increasing use of chemical fertilizers. If the manures cannot be utilized by the Parks Departments, etc., they can be disposed of best to operating refuse and sludge incinerators.

Alternatives Considered

Various alternatives were investigated with a view to determining the most economic acceptable long-range refuse disposal plan. Consideration was also given to attempting to ensure reasonable equity in direct haul costs between Area Municipalities within the overall plan. Sanitary landfill and central incineration were the only refuse disposal methods considered in the systems studies since, in our opinion, these are the only practicable methods for the disposal of solid wastes in this area.

All studies were based on the estimated quantities of publicly and privately collected wastes to be generated within Metropolitan Toronto by 1971, but excluding wastes of a special nature, such as liquid, manure, fly ash, trees, etc. Where the use of such figures produced alternatives of little cost difference, forecasts for later years were employed to test the effect of time on the comparison. In computing costs haul distances to proposed or existing disposal facilities were calculated on the basis of the current routing programme for refuse collection employed by the various Area Municipalities in reference to the planning districts previously set out.

Systems involving various combinations and percentages of direct haul, transfer haul, existing incinerators, new incinerators and sanitary landfill were subject to cost analyses. In these analyses, and based on previous observations, it was considered that the only existing incinerators capable of performing a useful function in the long range plan for refuse disposal, were the Commissioner's Street, Ingram Drive and Dufferin Street incinerators. These three are the only existing incinerators which can be operated for less cost than the cost of building and operating new incinerators. For some time ash residue from Ingram Drive and Duffering Street can be disposed of at the incinerator sites and that from Commissioner's Street can continue to be disposed of at Pottery Road. None of the existing publicly owned landfill sites has adequate capacity remaining to justify consideration in the long term plan.

It was determined that a number of systems utilizing mainly sanitary landfill, extensive transfer and transfer haul, and various combinations of the Commissioner's Street Ingram Drive and Dufferin Street incinerators cost essentially the same. Systems including new incinerators were generally more expensive, increasing in cost as a greater percentage of refuse was incinerated.

Thirteen basic plan combinations with variations on each were studied in detail. Eight of these plans had estimated annual costs based on 1971 quantities and 1966 costs within six percent of a mean total annual cost of $8,600,000. Since such variation is within the normal range of accuracy for preliminary estimating, the schemes can be considered to be of the same cost order.

It was interesting to note that the five plans which considered direct haul by collection vehicles of all refuse to the disposal facilities exceeded the mean annual value of $8,600,000 by $1,000,000 or more. Complete use of direct haul could therefore not be considered as a practicable alternative.

Evaluation of the eight similar cost plans was then made taking into account such items as initial capital investment required, total capital investment and less tangible considerations such as future improvements in technology anticipated with respect to incineration and air pollution control, advantages of creating open space through landfill and the effect of continuing inflation on the relative costs of alternative schemes. Table XI-9 shows the detailed cost comparison of the eight plans considered to be of the same cost order based on 1971 quantities.

Final Observations

In reaching the Recommendations of this report and in selecting the most practicable long term plan of the eight finally considered, certain basic observations served to assist in identifying the most practicable plan and the problems associated with its recommendation. These final observations are as follows:

1. The only practicable long term disposal methods suitable for Metropolitan Toronto are central incineration and sanitary landfill.

2. There is sufficient desirable sanitary landfill space to last significantly past 1986. Whether or not increases in technology or other changes will permit the utilization of landfill space now considered unadvisable when the recommended space is exhausted is open to speculation.

3. Economic comparisons reveal that a refuse disposal system for the Metro area based largely on incineration would be more expensive than a disposal system based largely on sanitary landfill and transfer haul.

4. The economic comparisons are sensitive to the location, cost of development and characteristics of the landfill sites. They are based on the landfill sites recommended.

5. The economic analyses are also sensitive to possible changes in refuse characteristics, inflationary tendencies, and possible minor changes in the cost of conversion of energy. The system recommended should be able to be adapted to fit these changes.

   A system relatively high in capital costs with consequent high debt charges is not as adaptable to change as a system with relatively low capital expenditures and consequent low debt charges.

6. The system facilities must be sized and scheduled for installation so that capacity is available as required from the forecasts of refuse quantities. The forecasts are subject to change based on experience as it is gained.

7. Major capital expenditures are necessary to enable the implementation of any of the alternative long range plans. The expenditures will be particularly high during the first stages of development.

8. Any plan involving transfer haul and sanitary landfill can only be considered practicable when the Municipalities and/or the Ontario Municipal Board have given their approval to the acquisition of the properties required for landfilling purposes located in those Municipalities.

9. Even a plan based primarily on incineration must provide landfill sites for ash and non-incinerable refuse disposal and for the interim disposal of refuse until such time as new incinerators can be designed and constructed.

RECOMMENDATIONS

Selection

Three plans were given intensive study as the most advantageous of the eight considered to have a similar cost value. These plans are briefly described as follows:

1.* Continuing use of the existing incinerators at Commissioner's Street (with improved air pollution equipment) Ingram Drive and Dufferin Street by use of direct haul to them; the balance of refuse to be conveyed to sanitary landfills at Thackeray and Beare Road sites initially, with subsequent use of North Thackeray on the west, the Maple site to the north, and Pickering Number 1, 2 and 3 on the east, using six transfer stations initially ranging in size from 550 to 900 tons per day capacity, together with some immediate direct haul to landfills.

2. Continuing use of the existing incinerators at Commissioner's Street (with improved air pollution equipment) Ingram Drive and Dufferin Street, the addition of one new 1050 ton per day incinerator, with direct haul to both existing and new incinerators, with balance of the refuse to sanitary landfills as in Plan 1 above, but using four transfer stations ranging in initial capacity from 550 to 900 tons per day, together with some immediate direct haul to landfills.

3. Continuing use of Commissioner's Street, Ingram Drive and Dufferin Street incinerators by use of direct haul to them. Addition of one new 1050 ton per day incinerator in the Bermondsey area, addition of one new 900 tons per day incinerator in the Wellington area, addition of one new 900 ton per day incinerator in the Kipling area, with direct haul to both existing and new incinerators, with balance of the refuse to sanitary landfills, as in Plan 1 above, using two transfer stations initially ranging in size from 560 to 720 tons per day capacity together with direct haul of some refuse to landfills.

** Plans 1, 2 and 3 are identical with Plans 7, 11 and 13 of the Technical Discussion.*

All three of the foregoing long range plans are based on sound engineering; they provide reasonably short haul distances to the disposal facilities for each of the Area Municipalities and also result in reasonable equity in the haul costs of each.

Plan 1, however, is the best suited to the Metropolitan Corporation needs when all factors previously listed are considered and is the most economical of the three alternatives. A significant advantage with respect to the cost of Plan 1 is that its capital investment over the first five years is $5 million less than for Plan 2 and $11 million less than for Plan 3. Total annual costs for Plan 1 are also lower than for either of the alternative plans. It must be emphasized that all property requirements in relation to the recommended Plan 1 must be established with respect to its development before its major phases can be implemented. In the interim, only those works common to all three plans can be proceeded with (including of course, the interim landfills of Thackeray and Beare Road).

The economics of this plan can only be achieved if Metro can successfully acquire and operate the long range disposal sites on which the plan is based, either with the approval of the Municipality involved or failing that with the approval of the Ontario Municipal Board. If a clear undertaking cannot be obtained to assure the availability of such sites for disposal purposes at an early date following adoption of the recommended plan, the expenditure of substantial capital sums for the construction of those Plan 1 facilities which are not common to the other two plans could not be justified.

Since the interim fills only have sufficient capacity for about four years operation it is essential that all necessary development work be undertaken during the four year period to ensure that the facilities required at the end of the period will be ready for use. This time will be sufficient provided it can be determined at an early date whether or not the recommended long term landfill sites can be established. The decision will indicate which of the three alternative plans Metro must follow.

If it is confirmed that these sites can be established the detailed design and construction of the landfill site development works and the transfer stations included in Plan 1 should be initiated to ensure their completion in time.

If on the other hand, it is determined that some or all of the landfill sites cannot be established then Metro must turn toward incineration. The decision must be made to permit an adequate time interval for the design and construction of the alternate facilities required. These facilities will include one or more incinerators depending on the extent that sanitary landfill can be employed. A period of not less than three and a half years should be allowed for the site acquisition, detailed design and construction of these plants.

It is therefore evident that every effort must now be made to resolve the question of establishing the landfill sites and that the decision to proceed with the balance of Plan 1 works or to switch to alternative Plans 2 or 3 must be made at the latest by June, 1968.

On the basis that the practicability of obtaining the necessary landfill sites can be established at an early date, Plan 1 is definitely recommended as the optimum plan for adoption and the following detailed recommendations on staging are based accordingly.

Staging and Cost Estimates

It is recommended that the staging of the work required to implement the plan be arranged in five year increments as shown below.

1966 - 1970

1. Establish the Thackeray Sanitary Landfill site as quickly as possible in accordance with the recommendations of Appendix 'A' entitled "Metropolitan Toronto Refuse Disposal Study, First Interim Report" dated June 29, 1966 (estimated cost is exclusive of possible land acquisition costs and costs associated with improvements to Steeles Avenue)

   $ 900,000

2. Establish the Beare Road Sanitary Landfill site as quickly as possible in accordance with the recommendations of Appendix 'B' entitled "Metropolitan Toronto Refuse Disposal Study, Second Interim Report", dated September 26, 1966.

   $1,150,000

3. Install air cleaning equipment sufficient to meet at least the proposed new air pollution by-law requirements in Commissioner's Street Incinerator.

   $1,000,000

4. Construct a 900 tons per day transfer station in the vicinity of the existing Wellington Street Incinerator.

$1,750,000

5. Construct a 550 tons per day transfer station near the North York Department of Works yard near Bermondsey and Eglinton.

$1,350,000

6. Construct a 720 tons per day transfer station in the area of Kiping Avenue and the C.P.R.

$1,650,000

7. Construct a 720 tons per day transfer station in the area of McCowan Road and Eglinton Avenue.

$1,650,000

8. Construct a 720 tons per day transfer station near Castlefield Avenue and Bathurst Street.

$1,650,000

9. Construct a 560 tons per day transfer station near Victoria Park and Finch Avenue.

$1,350,000

10. Continue the operation of the Ingram Drive and Commissioner's Street incinerators and operate the Dufferin Street incinerator when it is completed. Phase out all other incinerators as alternative methods of disposal become available with the establishment of the previously recommended facilities.

11. Establish a neutralization plant preferably at the Main Sewage Treatment Plant for the treatment of alkaline and acidic liquid wastes. (This plant to be established in stages to determine optimum methods of operation etc.)

$1,500,000

12. Negotiate with Ontario Department of Health and establish an inflammable liquid open burning facility outside the Metropolitan Planning Area.

$ 250,000

13. Establish the North Thackeray Sanitary Landfill site. $7,650,000

14. Establish the Pickering 1 Sanitary Landfill site. $2,200,000

15. Extend the Pottery Road incinerator residue disposal site. $ 75,000

1971 - 1976

1. Increase the capacity of the following transfer stations:

Kipling Avenue - from 720 to 900 tons per day	$ 90,000
McCowan Road - from 720 to 840 tons per day	$ 60,000
Victoria Park - from 560 to 670 tons per day	$ 55,000

2. Construct a 720 tons per day transfer station in the vicinity of Rockcliffe Boulevard and Corbett Avenue.

$1,650,000

1976 - 1986

1. Increase the capacity of the following transfer stations:

   Rockcliffe Boulevard - from 720 to 1000 tons per day

   Castlefield Avenue - from 720 to 960 tons per day

   Bermondsey Road - from 550 to 960 tons per day

   McCowan Road - from 840 to 960 tons per day.

2. Construct a 960 tons per day transfer station in the vicinity of Toryork Drive and Weston Road.

3. Construct a 720 tons per day transfer station in the vicinity of Dean Park and Sheppard Avenue.

4. Establish the Maple Sanitary Landfill site.

5. Establish the Pickering 2 and Pickering 3 Sanitary Landfill sites.

The capital cost estimates for each increment are based on an Engineering News Record cost of construction index of 1050 and must be adjusted according to the index pertaining at the time of construction. These estimates are also subject to possible adjustment as a result of detailed preliminary and final engineering studies.

Fig. XII-1 shows the locations of the recommended facilities.

Estimated costs are not given for facilities required past 1975 since it is felt that it would be impracticable to prepare a realistic estimate to-day of works proposed for construction at that time in the future.

Policy

(a) General

In order to ensure successful implementation of the recommendations contained in this report certain basic policies should be established. These policies relate to administration, organization and financing of the disposal operations. Some are self-evident and already in practice but a statement of them will form a useful adjunct to this study.

(b) Standards

The standards recommended in this study for the design, development and operation of the disposal facilities are equal to the best current practices on the continent. The adherence to these standards is in keeping with the general high quality of operation attained by other Metro services. With respect to refuse disposal, such standards are, however, mandatory to prevent refuse from becoming a pollution hazard.

(c) Co-operation

The situation now existing in Metro is that one agency is officially responsible for refuse disposal while several independent public and private agencies are responsible for collection. For this system to function successfully, full and continuous co-operation is essential.

Metro has authority to designate where various types of refuse will be accepted and how much each facility can take. It has no control, however, over the total quantity of refuse it may be required to accept.

For optimum operation by public and private collectors, it is necessary that these agencies are informed of the location of disposal facilities that they may use and that they be given as much notice as possible of any contemplated change.

In order to permit the necessary exchange of information between the interested parties, it is suggested that a technical committee be established. The membership would comprise representatives of Metro and public and private collection agencies.

(d) Records and Review

Many possible unforseen changes may occur in technology, refuse characteristics, etc., which may necessitate modifications to the long range plan as recommended in this study. In order to facilitate such adjustments, complete and concise records of past performance and characteristics are necessary. Special care must be taken in establishing a system which will ensure that such records are kept up to date and are in usable form. Aside from the necessary constant review of the study recommendations, it will be essential to submit them to a rigorous review at intervals not exceeding five years.

(e) Public Relations

In the past, refuse disposal practices in the Metropolitan Area, as in many other communities, have not always enjoyed the best public relations. To some degree this problem is inherent in refuse disposal, but too often it is the result of inadequate finances and effort on behalf of the disposal agency. The basis for good public relations is to conduct a first class disposal operation and then ensure that the public are made fully aware of the problems facing the disposal agency and the energetic approach which is taken toward their solution. A sound public relations programme will amply repay its cost by engendering public confidence and in facilitating public approval for the funds required for operation and future expansions of the disposal facilities.

(f) Charges for Refuse Disposal

As has been shown, the development and operation of a proper regional refuse disposal plan in Metro is a costly undertaking. Bill 81 in its current form is explicit in stating that charges cannot be levied directly against a municipality for the cost of disposal. The revenue required from the municipalities to sustain the municipal portion of the disposal operation, will therefore presumably be met from general taxation. Since there is equalised assessment throughout Metro it follows, in effect, that each municipality will contribute according to its assessment only, irrespective of the type of disposal facility actually utilized or the quantity of refuse generated by the individual municipality.

While exempting Area Municipalities or their agents Bill 81 does contain provisions to charge fees to others for disposal of wastes. In order to maintain some consistency with the equalisation in charges which exists for municipalities, it would appear logical to eventually make charges to private haulers equal at all disposal facilities. While this policy is probably not feasible initially it should be capable of attainment as the facilities required for the long range plan are brought into operation and the provisions of the following sub-section relating to haul and destination can be implemented. In our opinion, the actual fees charged for private disposal should reflect the average unit costs of such disposal determined on a Metro-wide basis.

(g) Refuse Origin - Destination Control:

In order to avoid unpredictable and undesirable fluctuations in refuse capacity requirements at the various disposal facilities, it will be necessary for Metro to make specific efforts to police the origin-destination of refuse. Any situations which might make it attractive to the collection and hauling agencies to deviate from Metro's desired delivery pattern should be avoided.

The municipally collected refuse delivery pattern should be able to be established by consultation with the Area Municipalities. By establishing this pattern, quantity variations other than seasonal variations should be virtually eliminated. Any major deviation will not only tend to destroy the economics of the recommended plan but may also destroy the general equity of haul costs established in this plan among the Area Municipalities.

The control of origin-destination of privately collected refuse will probably be more involved. One procedure that appears to be advantageous in eliminating some of the incentive to a private hauler to decide himself where to dispose of the refuse he collects would be to charge a uniform fee at all disposal facilities. This procedure is also consistent with other considerations previously mentioned. Another procedure which would have a similar beneficial effect would be to insist that all refuse collected in a specific area, either municipally or privately, be delivered to the same disposal facility. Since the disposal facilities as recommended are reasonably strategically located, this means that the privately collected refuse would generally go to the disposal facility nearest to the refuse pickup point. This procedure has a secondary benefit in that it tends to dilute the seasonal load factor effect of municipally collected refuse since the privately collected refuse does not vary significantly with the season.

There is no provision in Bill 81 granting Metro control over privately operated disposal facilities. Since Metro is by legislation responsible for refuse disposal, serious

disruptions could be caused to the Metro disposal system by uncontrolled introduction and/or withdrawal of privately operated disposal facilities. However if the Metro disposal system is operated efficiently and charges made reflect only actual costs, much of the incentive to private competition should be removed.

(h) Future Developments in Technology

As has been mentioned previously, the problems of refuse disposal are being subjected to analysis by qualified groups to a degree never before experienced. The possibilities of these efforts affecting advantageous changes in refuse disposal must be realized. To be able to judge the value of new suggestions requires conscientious study by those responsible to keep abreast of new developments. This can be accomplished in a variety of ways such as participating in technical conferences, encouraging suggestions and experiments by private entrepreneurs and actively cooperating in research with such groups as the Department of Health of the Province of Ontario.

CONCLUSIONS

The foregoing recommendations result from a concerted study of all factors and conditions that are important to and which influence the establishment of an optimum long term plan for refuse disposal in Metropolitan Toronto. By following these recommendations on plan and policy alike it is believed that the Corporation can provide maximum protection to the environmental health of the population of the area over the next 20-year period insofar as it might be jeopardized by inadequate refuse disposal policies.

The recommended plan will also provide the most economic solution to the problem in respect to both annual cost and capital investment. It is hoped that with regard to this plan, the necessary properties required for the landfills can be soon proven available. If not it will be necessary to proceed with alternate plans which although based on sound engineering and practicable environmental control procedures cannot be accomplished with as low a level of capital investment as the plan recommended.

These alternate plans are founded on incineration to a increasing degree and with the changing state of that process including attendant air pollution control facilities and the further improvements that can be anticipated in the next few years, it would be well if a major investment in this area could be postponed.

The Corporation is indeed favoured in the matter of refuse disposal in having the opportunity of utilising either landfill or incinerator procedures. The adoption of a long term plan wherein both methods are integrated for optimum efficiency will be a further and major step in ensuring the continued health, growth and prosperity of Metropolitan Toronto.

ACKNOWLEDGEMENTS

A study of this type could not have been undertaken without the active cooperation of a large number of persons representing the many Provincial, Municipal, Public and Private organizations which have interests in the refuse disposal problem and were able to furnish the essential basic data on which the study was based. To all these persons we extend our sincere thanks.

Particularly we wish to express our deep appreciation for the cordial assistance afforded throughout the entire study by Mr. R.L. Clark, Commissioner of Works, Metropolitan Toronto and members of his staff.

All of which is respectfully submitted.

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EXISTING COLLECTION PRACTICES TABLE 1

		RESIDENTIAL			COMMERCE		INDUSTRIAL	SPECIAL REMARKS
		Garbage	Bulky Refuse	Apartments	Public Collections	Private Collections		
BOROUGH OF EAST YORK	East York	2 per week at curbs	one per week – no leaves	2 per week – no incin. ash collection	as much as possible	some	collected privately	certain facilities six days per week.
	Leaside	"	one per week – leaves included	ash and refuse as for residential	some	most	"	–
BOROUGH OF ETOBICOKE	Etobicoke	"	collected with garbage	collected at night privately	none	collected at night	"	plastic bags used
	Long Branch	"	one per week – leaves included	as for residential incl. ashes	2 per week as for residential	none	"	plastic bags encouraged
	Mimico	"	"	"	daily from back lanes	–	"	–
	New Toronto	"	"	as for single apt. ash once/week	daily	–	"	plastic bags supplied
BOROUGH OF YORK	York	"	"	as for residential some ash collection	some night collection	most	"	–
	Weston	"	"	apartments all include ashes once per week	twice per week	–	"	–
BOROUGH OF SCARBORO		"	Request service once per week	apartment ash collected twice per week at night	twice per week	–	"	–
BOROUGH OF NORTH YORK		"	once per week – leaves included	apartment ash once per week	five times per week at night	none	"	–
CITY OF TORONTO	Toronto	"	once per week – leaves included	as for residential with ash once per week	some night collection	most	"	plastic bags encouraged
	Forest Hill	four per week private contractor	once per week at rear	ashes and refuse by private hauler	as for residential	–	none exists	–
	Swansea	2 per week at curbs	once per week	as for residential with ashes once/week	"	–	collected privately	plastic bags encouraged
Town of Ajax		once per week	–	as for residential	some	most	"	–
Township of Markham		2 per week in populated area only	None	as for residential	none	All must be done privately	"	collected by private hauler
Village of Markham		Assumes no responsibility for collections of any kind all must be arranged with private hauler.				"	"	–
Township of Pickering		2 per week in garbage area	no special service	as for residential	none	"	"	collection outside garbage area is done by private hauler
Village of Pickering		1 per week by private contractor	as requested	"	none	"	"	village arranges billing for service.
Town of Richmond Hill		1 per week by private contractor	once per month by town	"	none	"	"	–
Village of Streetsville		1 per week by municipality	no special service	"	some twice per week	remainder	some twice per week remainder privately	–
Town of Stoufville		1 per week by private contractor	no special service	"	none	all	collected privately	–
Township of Toronto Gore		1 per week by private contractor	← All arranged with private haulers →				"	must make individual arrangements.
Township of Toronto and Port Credit		1 per week by private contractor.	no special service	as for residential	none	all	"	by contract with Township.
Township of Vaughan and Woodbridge		not regulated	by Township	← Haulers make individual arrangements with all interested parties. →				

EXISTING DISPOSAL PRACTICES TABLE 2

		SANITARY LANDFILL				INCINERATORS								
		Number	Locations and Use	Life Expectancy	Industrial Charges	Number	Location and Capacity	Industrial Charges	Type	Age Years	Air Pollution Control Provision	Condition and Adaptibility to Expansion	Ash Disposal Arrangement	Remarks
BOROUGH OF EAST YORK	East York	1	Grenoble – Shared with North York. Philips – no burning	Less than one year	No industrial waste permitted no charges	–	–	–	–	–	–	–	–	–
	Leaside	1	"	"	"	–	–	–	–	–	–	–	–	–
BOROUGH OF ETOBICOKE	Etobicoke	2	Disco – weighed Centennial—weighed—non putrescible	Less than three	some charges	–	–	–	–	–	–	–	–	–
	Long Branch	1	all refuse disposed to	unknown	not provided	–	–	–	–	–	–	–	–	–
	Mimico	–	Berrill and Trustrum Landfill Site on Mississauga Rd.	–	–	1	jointly with New Toronto 9200 ton/year capacity	Not provided	–	–	inadequate	no storage capacity – operates during day only – unsuit.	private contractor disposes of ash	Private contractor disposes of items too large for incinerator
	New Toronto	–	–	–	–	1	jointly with Mimico 9200 ton/year capacity	Not provided	–	–	inadequate	"	"	"
BOROUGH OF YORK	York	1	Black Creek & Eglinton for bulky refuse & non combustibles	unknown	not permitted	1	disposal to Ingram incinerator 95,000 ton/year operated by North York	Not provided	–	–	–	–	–	
	Weston		Disposal at Maple Landfill operated by Disposal Services			–	–	–	–	–	–	–	–	
BOROUGH OF SCARBORO		1	Morningside Landfill accepts all waste generated in Township.	6 months	permitted at no charge	–	–	–	–	–	–	–	–	Scarborough have proposed proceeding with incinerator
BOROUGH OF NORTH YORK		2	Taryork for non combustibles Grenoble jointly with East York	less than one for both	not permitted	2	Ingram Drive with York Township. Duffs rin under const. – 85,000 tons/year	Limited number $5/ton	four mono hearth three mono hearth	16 under const.	adequate "	Good condition not adequate for expansion – new one is however	ash disposed on site for both	Cost of Ingram – $3.85 ton.
CITY OF TORONTO	Toronto	1	Pottery Road site for incinerator ash only	–	not permitted	4	Commissioners – 140,000 ton/year.	Limited disposal of $8/ton	six mono hearth	12	extensive revisions required	generally good and with revisions will be able to perform until 1986.	ash to Pottary Rd. Landfill	Leaves composted at Metro owned site in Don Valley
							Don incinerator – 30,000 tons/per year	"	3 rectangular furnaces stationary grates	50	poor	not satisfactory –	"	Some bulky refuse burned in open at foot of Leslie St.
							Symes Rd. 88,000 ton/year	Not provided	4 rect. furnace stationary grates	33	inadequate	Not well located and condition requires much improvements.	"	Cost of Commissioners $4.11/ton. Cost of Don–$7.95 t/y
							Wellington St. 67,000 ton/year	Limited disposal at $8.00 per ton	4 rect. furnace stationary grates	42	inadequate	not suitable for extension	"	Cost of Symes $5.28 ton
	Forest Hill		All non combustibles taken to Maple Landfill.			1	near Bathurst & Eglinton 7,500 tons/year	Not provided	two mono hearth	10	adequate	Restricted site and inadequate storage	ash hauled by contractor to Maple Landfill	Cost of Wellington $8.11/ton Cost of Forest Hill $6.41/ton
	Swansea	–	–	–	–		disposal at Symes Rd. unit to fee	–	–	–	–	–		All bulky refuse disposal must be arranged by individuals.
Town of Ajax		1	Municipal dump – most refuse burned – industries can dump	without burning 6 months	no charges	1	at Dump – to burn mainly industrial refuse.	None	open pit type with forced draft	new	completely inadequate	not capable of extension	on site	"
Township of Markham		1	Whitchurch Township – responsibility of Collection contractor	unknown	unknown	–	–	–	–	–	–	–	–	
Village of Markham			Private haulers generally dispose of Pickering Twnship fill Liquids go to Maple Landfill.			–	–	–	–	–	–	–	–	Backyard incinerators are permitted
Township of Pickering		1	Pickering dump – all refuse private or public – Controlled burning	not estimated	charges for outside Township uses.	–	–	–	–	–	–	–	–	–
Village of Pickering			Contractor has permission to use Pickering Twp dump Contractors utilize Whitchurch dump		–	–	–	–	–	–	–	–	–	Backyard incinerators are permitted
Town of Richmond Hill			Contractors utilize Whitchurch dump Mun. uses Vaughan Township dump for Municipally collected bulky refuse			–	–	–	–	–	–	–	–	
Village of Sheetsville			Disposed to Berrill and Trustrum Landfill			–	–	–	–	–	–	–	–	
Town of Stouffville			Disposed to private fill in Uxbridge Township			–	–	–	–	–	–	–	–	Village burns its own leaves and trees.
Township of Toronto Gore			Disposed to private dump in Albion Township			–	–	–	–	–	–	–	–	–
Township of Toronto and Port Credit			Disposed to Berrill and Trustrum Landfill			–	–	–	–	–	–	–	–	–
Township of Vaughan and Woodbridge		1	Dump site provided by Township Northeast of Maple – No liquid wastes permitted – Woodbridge pays for Residential Services.			–	–	–	–	–	–	–	–	–

TABLE V–1

POPULATION PROJECTION

METROPOLITAN PLANNING AREA

Planning District	Population Forecast				
	1966	1971	1976	1981	1986
1	126,400	131,200	139,200	142,000	142,000
2	241,600	247,700	257,200	262,100	262,300
3	238,000	254,400	258,000	259,000	259,000
4	207,250	219,250	230,700	239,700	245,400
5	82,000	108,200	128,500	132,000	133,900
6	232,500	240,750	254,300	259,900	259,900
7	64,200	66,200	67,700	68,400	68,400
8	154,000	172,000	181,000	188,000	193,800
9	42,500	55,300	64,200	71,000	74,500
10	80,600	114,000	130,000	142,000	151,000
11	117,000	140,000	155,200	167,000	170,300
12	16,500	33,500	49,000	66,500	76,500
13	178,000	196,000	207,000	212,500	217,000
14	53,700	59,100	64,600	68,600	72,000
15	22,000	45,500	66,000	94,500	115,000
16	27,000	55,000	96,000	145,000	195,000
Metro Area	1,883,250	2,138,100	2,348,600	2,518,200	2,636,000
17	30,000	53,000	88,000	147,000	215,000
18	72,000	102,000	140,000	179,000	218,000
19	7,680	8,100	8,500	8,800	9,200
20	47,000	69,000	96,000	124,000	154,000
21	16,200	19,400	22,600	25,750	29,300
22	4,420	4,500	4,600	4,650	4,700
23	37,700	64,200	84,100	104,000	123,000
Fringe Areas	215,000	320,200	443,800	593,200	753,200
Metro Toronto Planning Area	2,098,250	2,458,300	2,792,400	3,111,400	3,389,200

TABLE V–2

ESTIMATED REFUSE QUANTITIES

Municipally Collected Refuse

Planning District	Municipally Collected Refuse in Tons				
	1966 tons/year	1971 tons/year	1976 tons/year	1981 tons/year	1986 tons/year
1	89,800	111,500	126,500	137,400	145,900
2	78,000	97,200	108,000	117,200	124,400
3	101,300	123,300	133,700	143,000	151,700
4	80,500	98,500	110,900	122,700	133,300
5	24,000	42,500	53,900	59,000	63,600
6	89,200	108,100	122,200	133,000	141,200
7	24,900	31,000	33,800	36,400	38,600
8	56,800	72,900	82,000	90,800	99,300
9	11,100	21,200	26,200	31,000	34,500
10	24,500	43,400	52,900	61,600	69,600
11	46,400	63,400	75,200	86,200	93,300
12	6,900	15,100	23,600	34,100	41,600
13	70,500	90,700	102,500	112,200	121,600
14	20,900	27,100	31,700	35,900	39,900
15	2,000	16,700	25,900	39,400	51,000
16	5,300	19,400	36,100	58,100	82,800
Metro Area	732,100	982,000	1,145,100	1,298,000	1,432,300
17	10,200	19,400	34,400	61,100	94,900
18	24,400	37,200	54,600	74,500	96,200
19	2,600	2,900	3,300	3,700	4,000
20	16,000	25,200	37,500	51,600	68,000
21	5,500	7,100	8,900	10,700	12,900
22	1,500	1,600	1,800	2,000	2,100
23	12,800	23,400	32,800	43,200	54,200
Fringe Areas	73,000	116,800	173,300	246,800	332,300
Metro Toronto Planning Area	805,100	1,098,800	1,318,400	1,544,800	1,764,600

TABLE V–3

ESTIMATE OF DESIGNATED COMMERCIAL AND INDUSTRIAL LAND USE

Planning District	Designated Commercial and Industrial Land Use in Acres				
	1966 acres	1971 acres	1976 acres	1981 acres	1986 acres
1	2,200	2,600	2,800	2,900	2,969
2	740	800	830	840	845
3	1,970	2,160	2,360	2,450	2,503
4	750	810	840	860	858
5	980	1,200	1,320	1,370	1,399
6	605	605	605	604	604
7	1,060	1,360	1,500	1,550	1,570
8	1,500	2,000	2,600	2,900	2,985
9	1,600	2,700	3,500	4,000	4,171
10	1,460	2,400	3,000	3,400	3,776
11	320	350	380	410	431
12	200	360	420	480	634
13	2,150	3,000	3,200	3,300	3,503
14	230	300	360	410	464
15	250	360	450	530	632
16	800	1,800	3,100	4,000	4,855
Metro Area	16,815	22,805	27,265	30,004	32,199
17	900	1,600	2,600	3,700	5,039
18	2,000	3,300	5,400	7,200	9,283
19	40	160	250	330	430
20	1,250	1,400	1,700	2,200	4,908
21	100	200	300	400	742
22	0	0	0	0	0
23	450	700	1,000	1,900	3,811
Fringe Areas	4,740	7,360	11,250	15,730	24,213
Metro Toronto Planning Area	21,555	30,165	38,515	45,734	56,412

TABLE V–4

ESTIMATED REFUSE QUANTITIES

Privately Collected Commercial and Industrial Refuse

Planning District	Privately Collected Commercial and Industrial Refuse in Tons				
	1966 tons/year	1971 tons/year	1976 tons/year	1981 tons/year	1986 tons/year
1	69,800	88,600	102,100	112,600	122,300
2	17,000	19,800	22,000	23,600	25,200
3	45,300	53,400	62,400	69,100	74,900
4	17,300	20,000	22,200	24,300	25,600
5	22,500	29,700	35,000	38,600	41,900
6	13,900	14,800	15,900	17,000	18,100
7	24,400	33,600	39,700	43,700	46,900
8	34,500	49,500	68,800	81,700	89,300
9	24,000	46,400	68,400	88,200	103,000
10	33,600	59,300	79,400	95,800	107,600
11	7,400	8,700	10,000	11,500	12,900
12	4,600	8,900	11,200	13,500	16,100
13	49,500	74,200	84,600	93,000	101,700
14	5,300	7,400	9,500	11,500	13,500
15	5,800	8,900	12,000	14,900	17,900
16	12,000	31,000	60,600	88,200	111,200
Metro Area	386,900	554,200	703,800	827,200	928,100
17	9,000	20,600	41,900	72,500	105,300
18	20,000	42,600	86,900	141,100	198,900
19	400	2,000	4,000	6,500	9,400
20	12,500	18,100	27,400	43,100	70,200
21	1,000	2,600	4,800	7,800	14,000
22	0	0	0	0	0
23	4,500	9,000	16,100	37,200	70,200
Fringe Areas	47,400	94,900	181,100	308,200	468,000
Metro Toronto Planning Area	434,300	649,100	484,900	1,135,400	1,396,100

TABLE V–5

ESTIMATED QUANTITIES OF SOLID WASTES COLLECTED IN METROPOLITAN AREA

Type of Refuse	Quantities of Refuse (Solid Wastes)				
	1966 tons/year	1971 tons/year	1976 tons/year	1981 tons/year	1986 tons/year
MUNICIPALLY COLLECTED REFUSE	732,100	982,000	1,145,100	1,298,000	1,432,300
PRIVATELY COLLECTED REFUSE	386,900	554,200	703,800	827,200	928,100
SUB TOTAL (a)	1,119,000	1,536,200	1,848,900	2,125,200	2,360,400
OTHER SOLID WASTES					
Building Rubble, Waste lumber	48,000	50,000	50,000	50,000	50,000
Inert material	100,000	100,000	100,000	100,000	100,000
Trees	38,000	38,000	38,000	38,000	38,000
Ash from power generating stations	288,000	362,000	500,000	500,000	500,000
Street sweepings and catch basin cleanings	50,000	53,000	56,000	58,000	60,000
Manure	2,000	2,000	2,000	2,000	2,000
TOTAL QUANTITY OF SOLID WASTES	1,645,000	2,144,207	2,594,900	2,873,200	3,110,400

(a) Quantities used in the economic comparison studies.

PHYSICAL CHARACTERISTICS OF SITES INVESTIGATED

Site Number	Location	Refuse Capacity Million Cu. Yds.	Isolation	Local Access	Availability of Cover Material	Water Pollution Potential	Topographical Suitability	Suitable Refuse	Remarks
M-1	Maple Side Road and Leslie St.	Nil							
M-2	Woodbine Ave. & Hwy 7	9.5	Good	Good	Fair	High	Good Depression Fill	Inert	Near Markham Wells Pollution Control Uneconomical at this time
M-3	Steel's Ave. & Leslie St.	3.4	Good	Good	Fair	High	Good Depression Fill	Mixed	Near Markham Wells Pollution Control Uneconomical at this time
P-1	Concession 3 & Liverpool Rd.	11.3	Good	Good	Good	Low	Good Depression Fill	Mixed	
P-2	Concession 4 & Brock Rd.	10.5	Good	Good	Good	Medium	Good Depression Fill	Mixed	Pollution Control Feasible
P-3	Concession 5 & Church St.	13.1	Good	Good	Good	Low	Good Depression Fill	Mixed	
P-4	Concession 5 & Westney Rd.	Nil							
P-5	Concession 5 & Audley	Nil							
S-1	Morningside Ave. & Hwy 401	Nil							
S-2	Sheppard Ave. & Dean Park								Not Available
S-3	Kirkham's Rd. & Rouge River	0.28	Fair	Fair	Poor	Low		Inert	To be filled in conjunction with Beare Rd. Site.
S-4	Beare Road & Finch Ave.	5.5	Good	Fair	Good	Low	Good Depression Fill	Mixed	
S-5	Finch Ave. & Rouge River	21.5	Fair	Fair	Fair	Low	Poor Area Fill	Mixed	Topographically not a suitable site
S-6	Reesor Road & Passmore Rd.	Nil							
S-7	Finch Ave. & Lapp's Road	11.6	Good	Fair	Good	High	Fair Depression Fill	Mixed	Pollution Control Uneconomical
S-8	Steel's Ave. & Sewells Rd.	3.4	Good	Fair	Good	Low	Fair Area Fill	Mixed	
EY-1	Pottery Rd. Site	1) 0.91 2) 1.26	Fair	Good	Poor	Low	Fair Depression Fill	Inert	Suitable only for incinerator ash
EY-2	Southwest of Pottery Rd.	1.8	Fair	Good	Poor	Low	Good Depression Fill	Inert	Suitable in future for ash or inert material fill
EY-3	Overlea Blvd. & Don River								Area Uneconomical to Develop
NY-1	Steele's & Islington Ave.	Nil							
T-1	Etobicoke Creek & Burnhamthorpe Rd.	6.2	Good	Fair	Good	Low	Fair Area Fill	Inert	Access Uneconomical to Develop
T-2	Hwy 5 & Cawthra Rd.	Nil							
T-3	Hwy 5 at Cooksville	Nil							
T-4	Hwy 5 & Fourth Line	3.3	Good	Good	Fair	Medium	Fair Depression Fill	Mixed	
T-5	Fifth Line & South Britannia Rd.	Nil							
T-6	Fifth Line & North Britannia Rd.	Nil							
T-7	C.E.W. & Southdown	2.55	Fair	Good	Good	Medium	Fair Depression Fill	Mixed	Site in operation by others
V-1	Dufferin St. & 19th Ave.	3.8	Good	Good	Good	Medium	Fair Depression Fill	Mixed	Could be utilized with the Maple Site
V-2	Maple Site	60.5	Good	Good	Good	Low	Good Depression Fill	Mixed	38.5 million cu. yds. with no further removal of granular cover
V-3	Thackeray Site	4.9	Good	Good	Fair	Medium	Good Depression Fill	Mixed	Pollution Control Feasible – Cover available in vicinity
V-4	North Thackray	18.2	Good	Good	Good	Medium	Good Depression Fill	Mixed	Pollution Control Feasible
V-5	Hwy 27 & Maple Side Rd.	2.7	Good	Good	Fair	Medium	Good Depression Fill	Mixed	Pollution Control Uneconomical in lieu of size
V-6	North of Carrville Rd. & Hwy 27	Nil							
V-7	Boyd Conservation Area (Woodbridge)								Not Available
V-8	Hwy 27 at Elder Mills	Nil							
V-9	Nashville Reservoir Area								Not Available
V-10	West of Hwy 27 at 19th Ave.	32.2	Good	Good	Good	Low	Good Area Fill	Mixed	
V-11	West of Hwy 27 at 18th Ave.	30.0	Good	Good	Good	High	Good Area Fill	Mixed	Site could possibly be developed beyond study period.
Y-1	Rockcliffe Blvd. & Hiltsborne	6.6	Poor	Good	Poor	High	Fair Depression Fill	Mixed	Pollution and gas control not feasible
Y-2	Eglinton Flats	3.6	Poor	Good	Poor	High	Poor Depression Fill	Mixed	

TABLE VII–2

SUMMARY OF DEVELOPING AND FINISHING COSTS FOR RECOMMENDED SITES

Site Number	Lacatian	Refuse Capacity Million Tans	Land Area Acres	Capital Cast af Develaping $	Capital Cast af Finishing $	Tatal Cast $
M-3	Steele's Ave. and Leslie St.	1.2	40	424,000	161,000	585,000
P-1	Concessian 3 and Liverpaol Rd.	3.9	350	1,669,000	790,000	2,459,000
P-2	Concession 4 and ~~Church St~~. Brock Rd.	3.7	320	1,692,000	1,440,000	3,132,000
P-3	Cancessian 5 and Church St.	4.6	387	2,125,000	891,000	3,016,000
S-4	Beare Raad and ~~Church St~~. Finch Ave	1.9	190	1,017,000	448,000	1,465,000
S-8	Steele's Ave. and Sewell's Rd.	1.2	300	1,295,000	527,000	1,822,000
V-1	Dufferin St. and 19th Ave.	1.3	112	459,000	281,000	740,000
V-2	Maple Site	21.0	745	9,895,000	1,314,000	11,209,000
V-3	Thackeray Site	1.7	113	689,000	498,000	1,187,000
V-4	Narth Thackeray Site	6.4	485	7,092,000	1,280,000	8,372,000
V-10	West of Hwy. 27 at 19th Ave.	11.3	950	4,747,000	2,568,000	7,315,000

TABLE VIII – 6

ESTIMATED ANNUAL COST

900 Ton Per Day Plant

CAPITAL INVESTMENT	$7,488,000		
	Annual Cost	80% L.F.* Per Ton Cost	90% L.F.* Per Ton Cost
FIXED COSTS	666,400	2.54	2.25
O & M COST			
plant labour	400,000	1.52	1.34
utilities	185,000	0.70	0.63
maintenance & supplies	66,600	0.25	0.23
TOTAL O & M COST	651,600	2.47	2.20
RESIDUE HAULING & DISPOSAL COST	169,000	0.64	0.57
TOTAL DISPOSAL COST	1,487,000	5.65	5.02
ANNUAL TONNAGE		263,000	296,000

**L.F. – Load Factor*

TABLE VIII – 7

ESTIMATED ANNUAL COST

1050 Ton Per Day Plant

CAPITAL INVESTMENT	$8,286,000		
	Annual Cost	80% L.F.* Per Ton Cost	90% L.F.* Per Ton Cost
FIXED COSTS	$737,500	$2.40	$2.14
O & M COST			
plant labour	400,000	1.31	1.16
utilities	215,900	0.70	0.63
maintenance & supplies	73,700	0.24	0.21
TOTAL O & M COST	689,600	2.25	2.00
RESIDUE HAULING & DISPOSAL COST	169,000	0.55	0.49
TOTAL DISPOSAL COST	$1,596,100	$5.20	$4.63
ANNUAL TONNAGE		307,000 tons	345,000 tons

**L.F. – Load Factor*

TABLE VIII – 8

ESTIMATED ANNUAL COST

1200 Ton Per Day Plant

CAPITAL INVESTMENT	$9,184,000		
	Annual Cost	80% L.F.* Per Ton Cost	90% L.F.* Per Ton Cost
FIXED COSTS	$817,400	$2.34	$2.07
O & M COST			
plant labour	400,000	1.15	1.01
utilities	246,700	0.70	0.63
maintenance & supplies	81,700	0.23	0.21
TOTAL O & M COST	728,400	2.08	1.85
RESIDUE HAULING & DISPOSAL COST	169,000	0.48	0.43
TOTAL DISPOSAL COST	$1,714,800	$4.90	$4.35
ANNUAL TONNAGE		350,000 Tons	394,000 Tons

L.F. – Load Factor

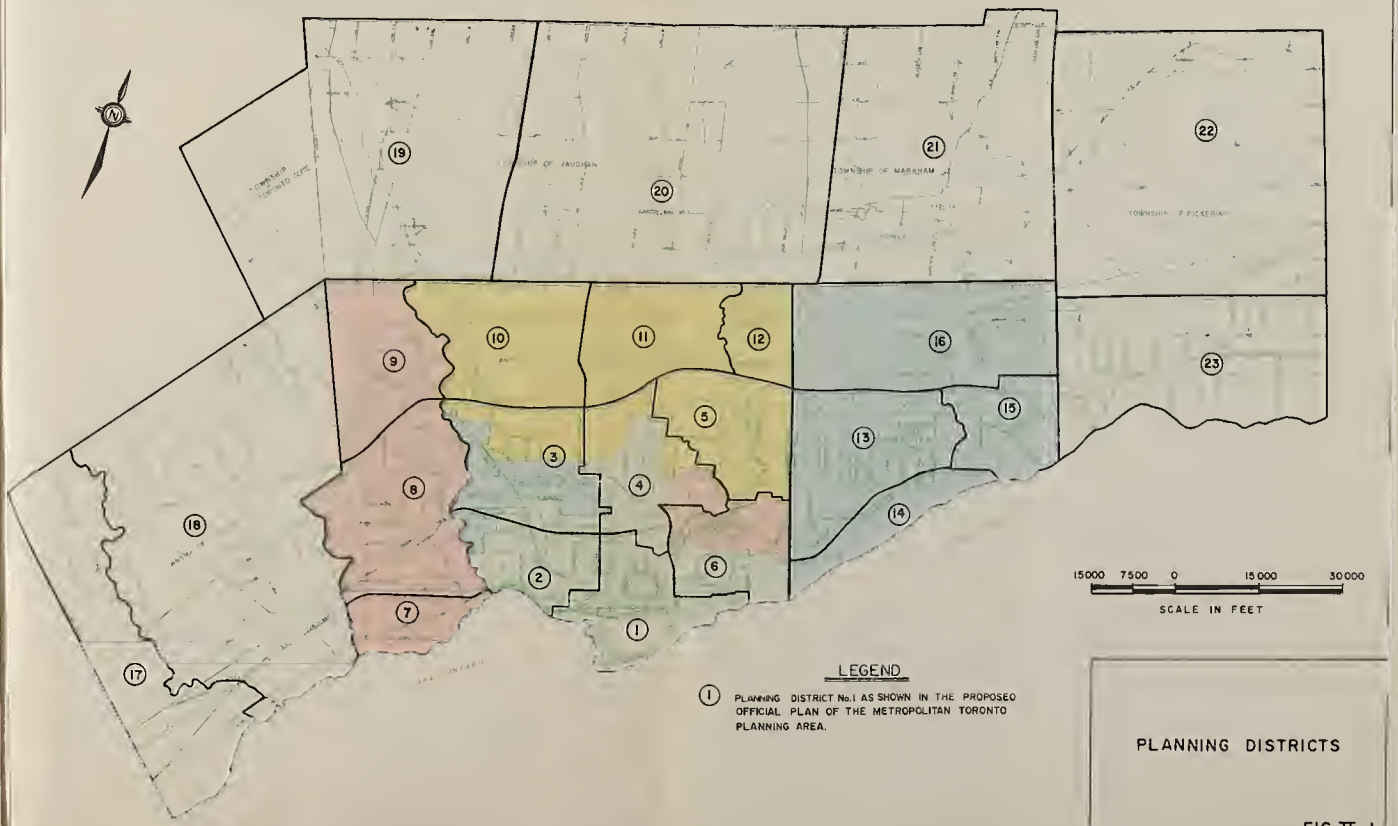
TABLE XI – 9

ALTERNATIVE PLAN COSTS – 1000 DOLLARS

1971 QUANTITIES

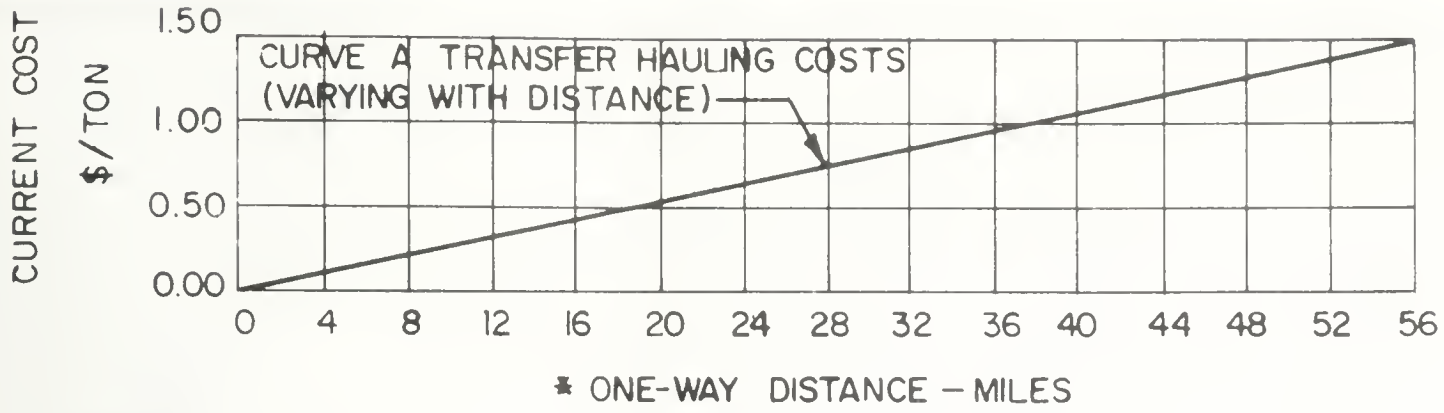
Item	Plan 6	Plan 7 *	Plan 8	Plan 9	Plan 10	Plan 11 *	Plan 12	Plan 13 *
Direct Haul	1,700	1,600	1,700	1,600	1,800	1,700	1,800	1,600
Transfer Haul	4,100	3,100	3,600	3,600	3,100	2,100	1,400	1,000
Disposal	3,000	3,600	3,300	3,300	3,500	4,700	5,500	6,500
Total	8,800	8,300	8,600	8,500	8,400	8,500	8,700	9,100

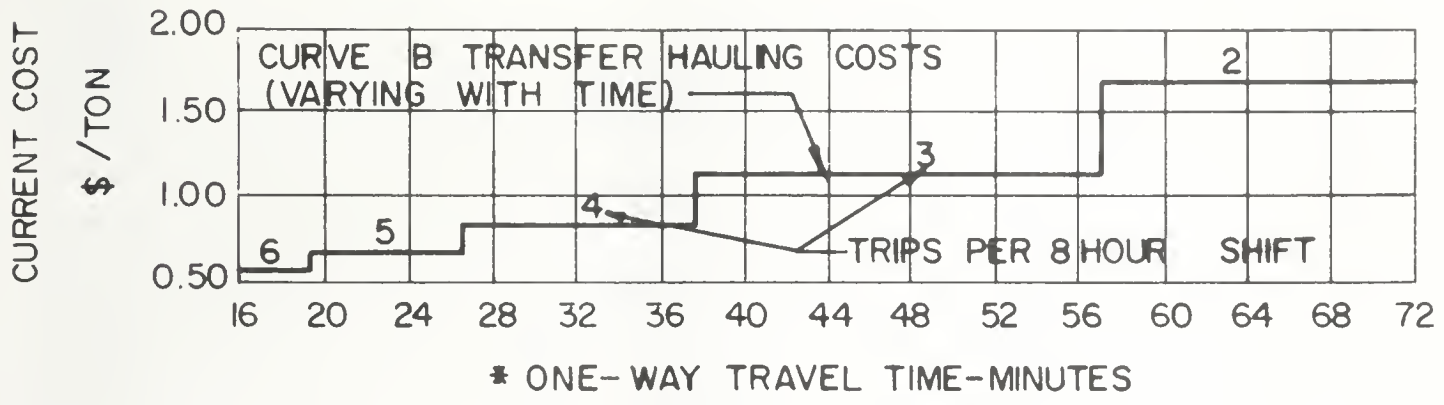
NOTE: 1. Based on 1966 Cost Levels
2. * Plans 7, 11 and 13 designated as Plans 1, 2 and 3 respectively in Report.

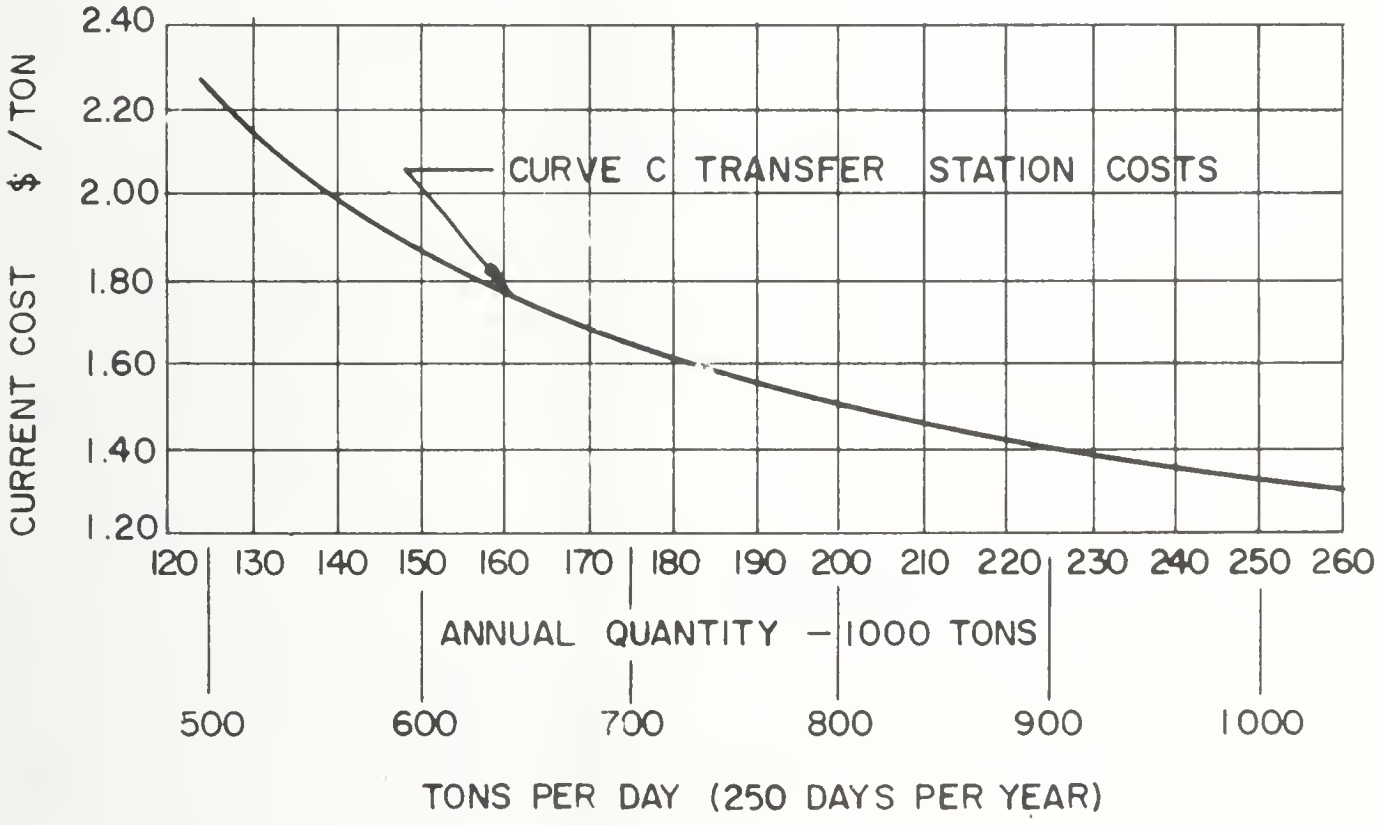


PLANNING DISTRICTS

FIG. V-1







* NOTE: HAUL COSTS ARE FOR ONE-WAY TRAVEL AND INCLUDE THE COST OF THE RETURN TRIP

TRANSFER HAUL COSTS

FIG. VI - 1

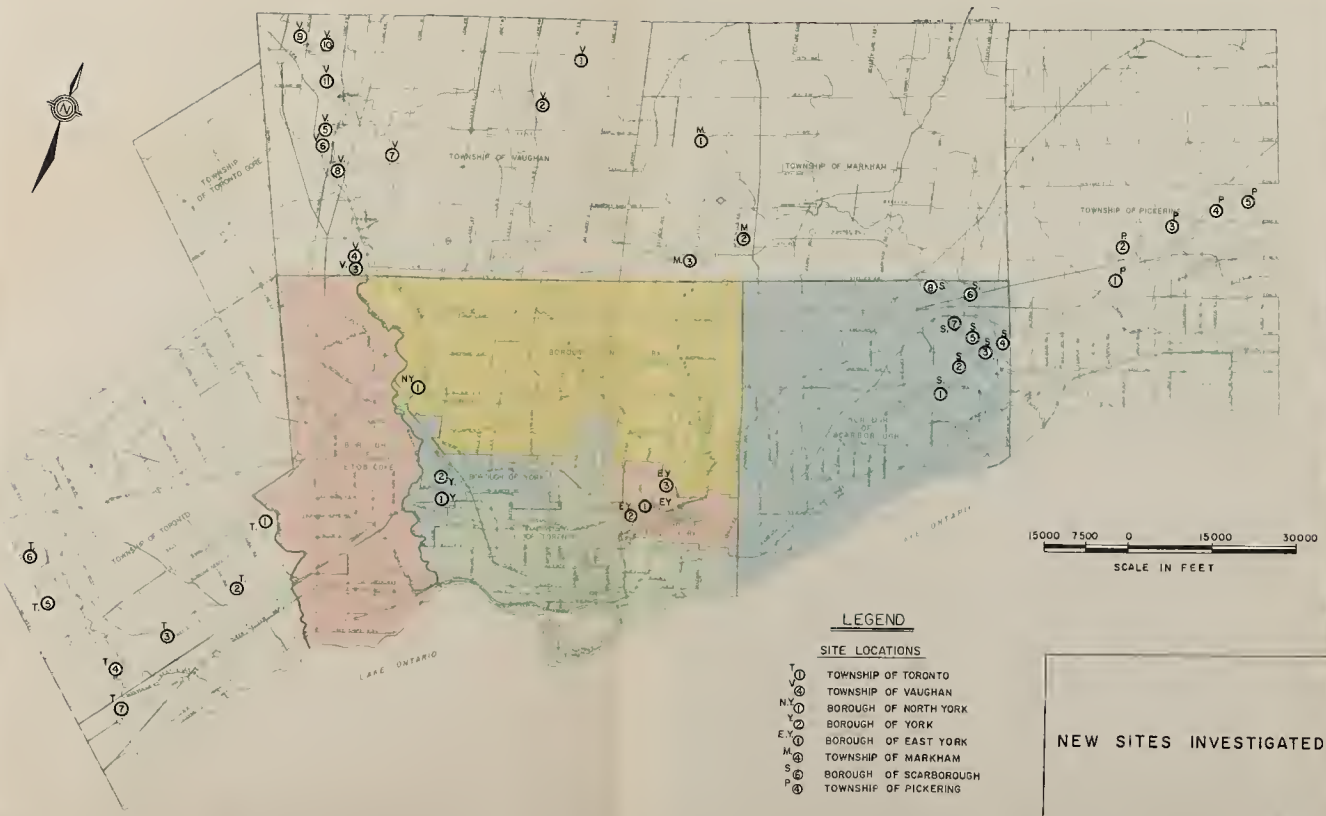
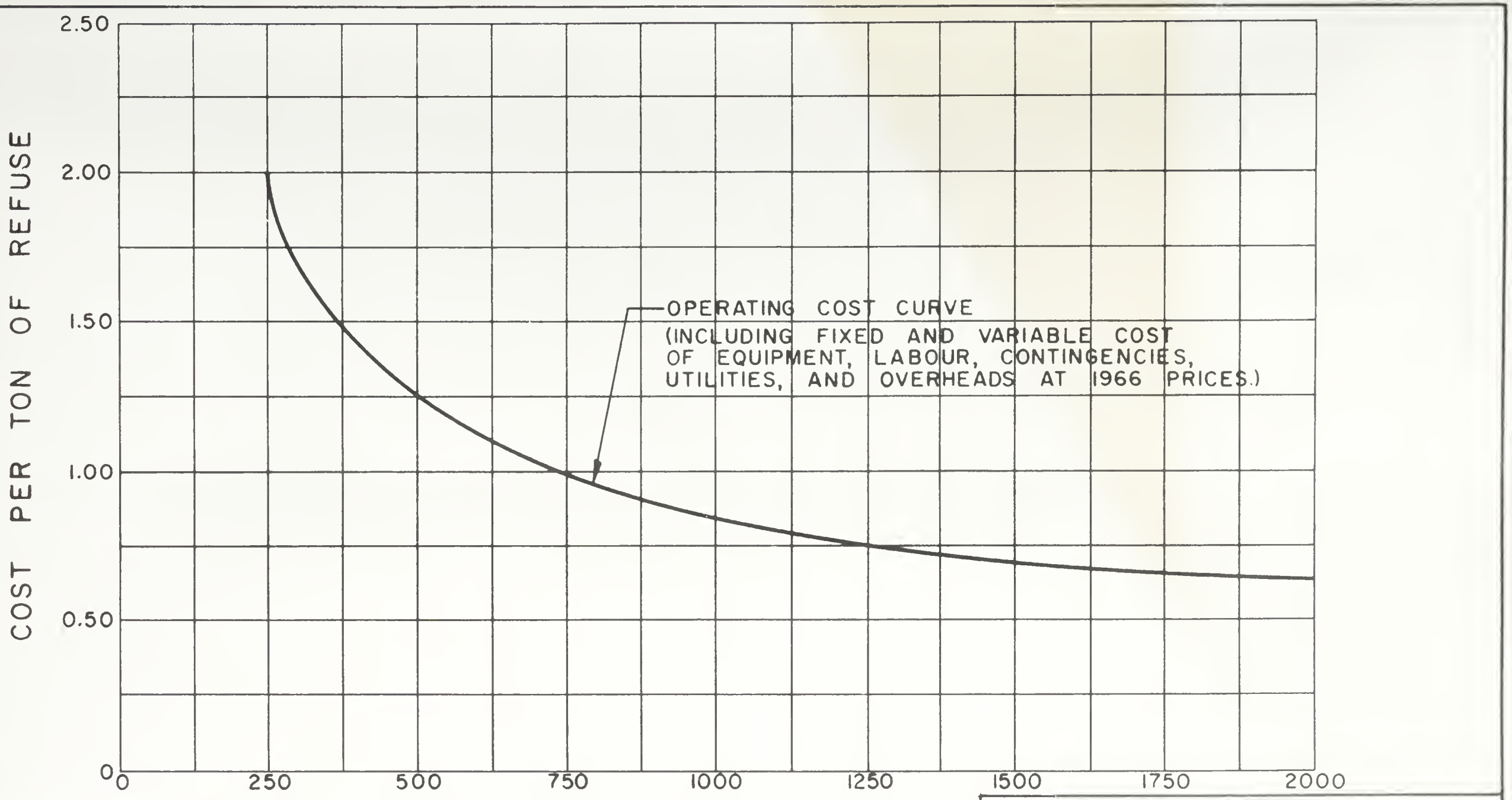
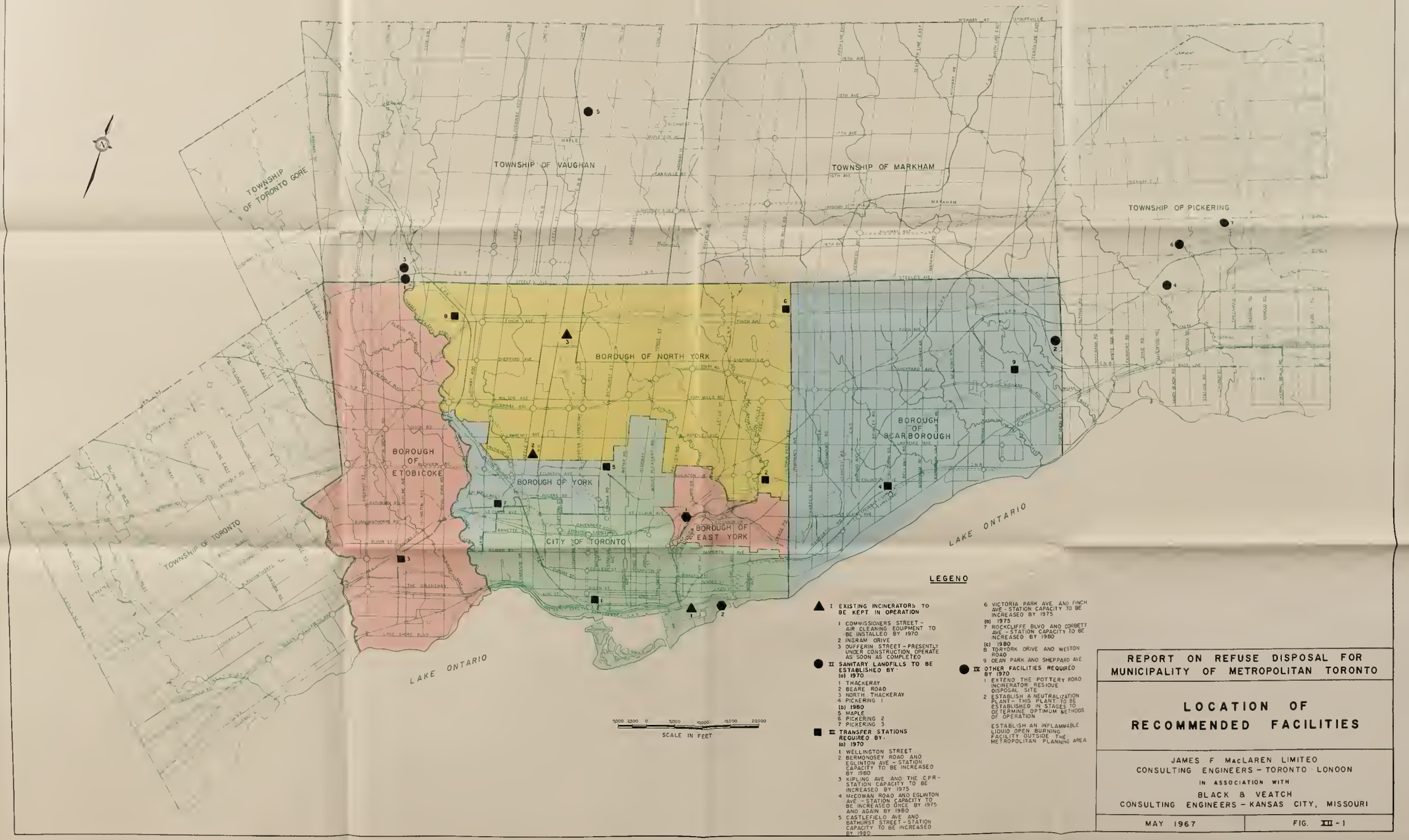

TOWNSHIP OF TORONTO GORE
TOWNSHIP OF VAUGHAN
TOWNSHIP OF MARKHAM
TOWNSHIP OF PICKERING
BOROUGH OF NORTH YORK
BOROUGH OF YORK
BOROUGH OF EAST YORK
BOROUGH OF SCARBOROUGH
TOWNSHIP OF TORONTO
LAKE ONTARIO
15000 7500 0 15000 30000
SCALE IN FEET
LEGEND
SITE LOCATIONS
T① TOWNSHIP OF TORONTO
V④ TOWNSHIP OF VAUGHAN
NY① BOROUGH OF NORTH YORK
Y② BOROUGH OF YORK
EY① BOROUGH OF EAST YORK
M④ TOWNSHIP OF MARKHAM
S⑥ BOROUGH OF SCARBOROUGH
P④ TOWNSHIP OF PICKERING
NEW SITES INVESTIGATED

FIG. VII-1



OPERATING COST CURVE

FIG. VII-5



LEGEND

▲ I EXISTING INCINERATORS TO BE KEPT IN OPERATION

1 COMMISSIONERS STREET - AIR CLEANING EQUIPMENT TO BE INSTALLED BY 1970
2 INGRAM DRIVE
3 DUFFERIN STREET - PRESENTLY UNDER CONSTRUCTION, OPERATE AS SOON AS COMPLETED

● II SANITARY LANDFILLS TO BE ESTABLISHED BY:

(a) 1970
1 THACKERAY
2 BEARE ROAD
3 NORTH THACKERAY
4 PICKERING 1

(b) 1980
5 MAPLE
6 PICKERING 2
7 PICKERING 3

■ III TRANSFER STATIONS REQUIRED BY:

(a) 1970
1 WELLINGTON STREET
2 BERMONDSEY ROAD AND EGLINTON AVE - STATION CAPACITY TO BE INCREASED BY 1980
3 KIPLING AVE AND THE C.P.R. - STATION CAPACITY TO BE INCREASED BY 1975
4 McCOWAN ROAD AND EGLINTON AVE - STATION CAPACITY TO BE INCREASED ONCE BY 1975 AND AGAIN BY 1980
5 CASTLEFIELD AVE AND BATHURST STREET - STATION CAPACITY TO BE INCREASED BY 1980
6 VICTORIA PARK AVE AND FINCH AVE - STATION CAPACITY TO BE INCREASED BY 1975

(b) 1975
7 ROCKCLIFFE BLVD AND CORBETT AVE - STATION CAPACITY TO BE INCREASED BY 1980

(c) 1980
8 TORYORK DRIVE AND WESTON ROAD
9 OEAN PARK AND SHEPPARD AVE

● IV OTHER FACILITIES REQUIRED BY 1970
1 EXTEND THE POTTERY ROAD INCINERATOR RESIDUE DISPOSAL SITE
2 ESTABLISH A NEUTRALIZATION PLANT - THIS PLANT TO BE ESTABLISHED IN STAGES TO DETERMINE OPTIMUM METHODS OF OPERATION

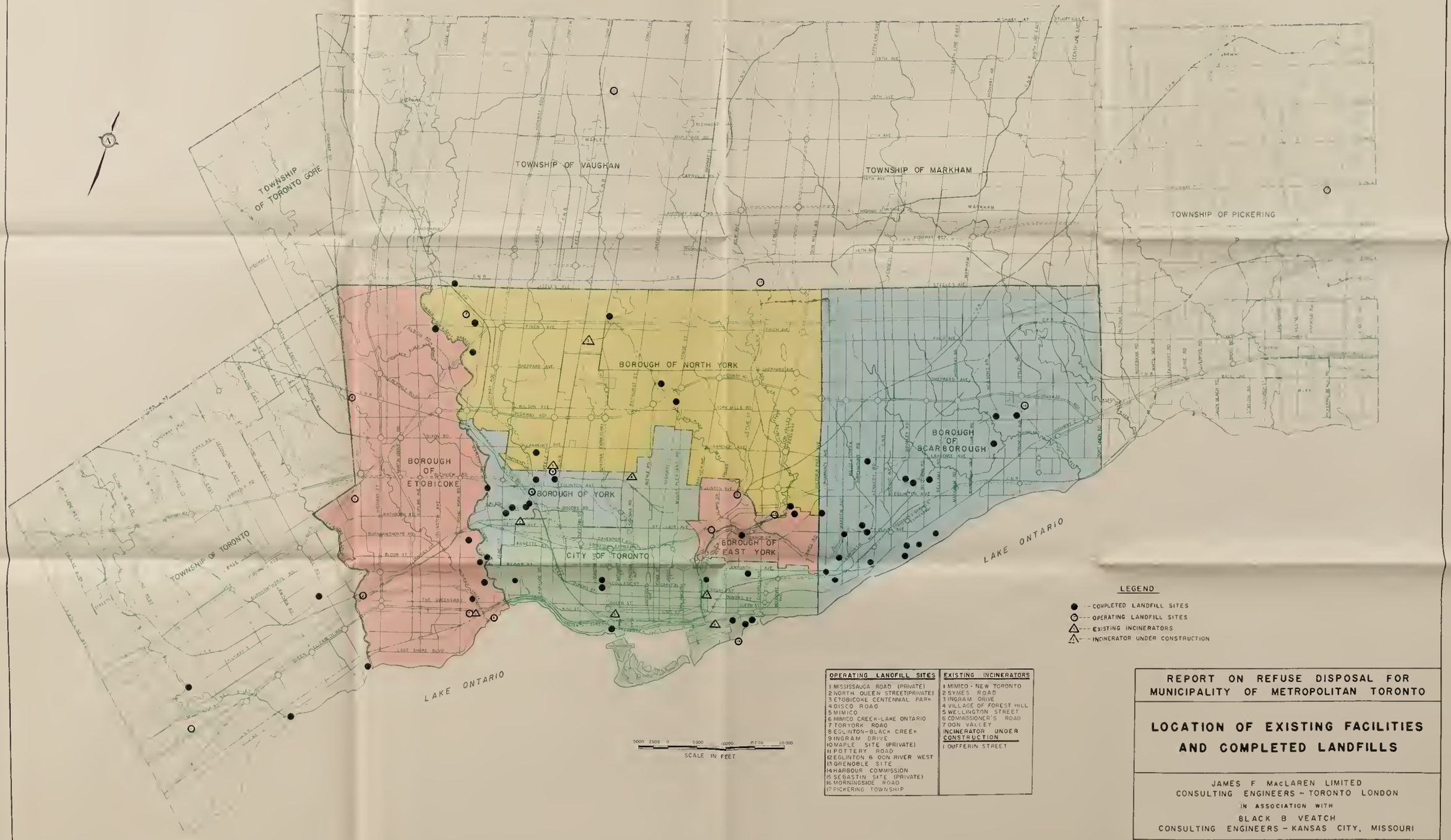
ESTABLISH AN INFLAMMABLE LIQUID OPEN BURNING FACILITY OUTSIDE THE METROPOLITAN PLANNING AREA

REPORT ON REFUSE DISPOSAL FOR MUNICIPALITY OF METROPOLITAN TORONTO

LOCATION OF RECOMMENDED FACILITIES

JAMES F MacLAREN LIMITED
CONSULTING ENGINEERS - TORONTO LONDON
IN ASSOCIATION WITH
BLACK & VEATCH
CONSULTING ENGINEERS - KANSAS CITY, MISSOURI

MAY 1967 | FIG. XII - 1



LEGEND

- COMPLETED LANDFILL SITES
- OPERATING LANDFILL SITES
- EXISTING INCINERATORS
- INCINERATOR UNDER CONSTRUCTION

OPERATING LANDFILL SITES	EXISTING INCINERATORS
1 MISSISSAUGA ROAD (PRIVATE)	1 MIMICO - NEW TORONTO
2 NORTH QUEEN STREET(PRIVATE)	2 SYMES ROAD
3 ETOBICOKE CENTENNIAL PARK	3 INGRAM DRIVE
4 OISCO ROAD	4 VILLAGE OF FOREST HILL
5 MIMICO	5 WELLINGTON STREET
6 MIMICO CREEK-LAKE ONTARIO	6 COMMISSIONER'S ROAD
7 TORYORK ROAD	7 DON VALLEY
8 EGLINTON-BLACK CREEK	INCINERATOR UNDER CONSTRUCTION
9 INGRAM DRIVE	1 DUFFERIN STREET
10 MAPLE SITE (PRIVATE)	
11 POTTERY ROAD	
12 EGLINTON & DON RIVER WEST	
13 GRENOBLE SITE	
14 HARBOUR COMMISSION	
15 SEBASTIN SITE (PRIVATE)	
16 MORNINGSIDE ROAD	
17 PICKERING TOWNSHIP	

REPORT ON REFUSE DISPOSAL FOR MUNICIPALITY OF METROPOLITAN TORONTO

LOCATION OF EXISTING FACILITIES AND COMPLETED LANDFILLS

JAMES F MacLAREN LIMITED
CONSULTING ENGINEERS - TORONTO LONDON
IN ASSOCIATION WITH
BLACK & VEATCH
CONSULTING ENGINEERS - KANSAS CITY, MISSOURI

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